73 Amateur Radio Today

JULY 1995
ISSUE #418
USA $3.95
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A WGI Publication
International Edition

STALK THE DESERT "FOX"!

Build:
- 2m Collinear Vertical Antenna
- DTMF Decoder
- Weather Satellite Reception:
  - Low-Noise Amplifier
  - 6-Foot Parabolic Dish

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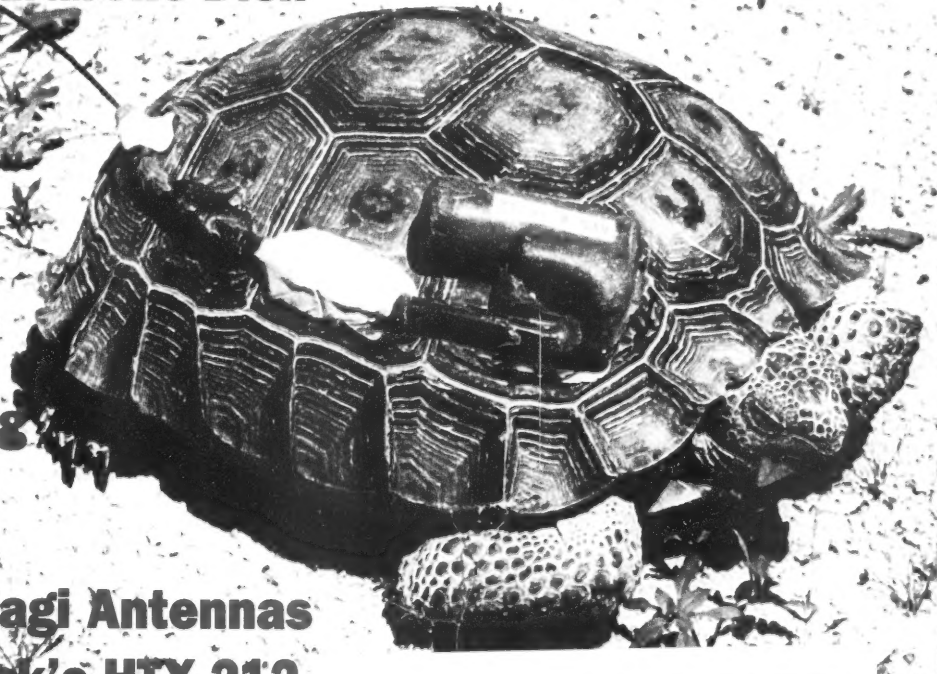
- DC Power Supplies

Laugh:
- Mikey's Big Adventure

Discover:
- Maldol's Yagi Antennas
- Radio Shack's HTX-212 2m Mobile Transceiver
- Pasokon's Slow-Scan TV



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300 N ZEEB RD
ANN ARBOR MI 48103-1553

ICOM HANDHELD TRANSCEIVERS

IC-V68

- For Export Only
- 136-174 MHz Tx/Rx
- 5 W @ 13.8 V DC
- 40 Memory Channels
- AA Battery Case (BP-99) standard. NiCd version also available (BP-160+BP-99)
- ANI (Automatic # ID)
- Cloning (via cable)
- Code Squelch/Paging
- Programming Manual Required
- PL Tone (88.5 hz) Built-in (38 others with the UT-86)
- PC Programmable
- Voice Scrambler (UT-88 Required)
- Fully Programmable

IC-U68

- Same features as V68
- 440 MHz

IC-2GXA

- For Export Only - Not Certified for U.S. Use
- 2 M
- 7 W @ 13.5 V DC
- 40 Memory Channels
- AA Battery Case (BP-130A) standard. NiCd version also available (BP-130A+BP-160)
- Wall charger incl. w/both models.
- No Touch Tone Pad
- C.T.C.S.S.
- Built-in PL Encode/Decode
- Auto Repeater Operation
- Tone Scan (UT-86)
- Channel Only Mode

IC-2GXAT

- 2 M
- 7 W @ 13.5 V DC
- 40 Memory Channels
- 700 mAh Battery
- Auto Repeater Operation
- Tone Scan
- DTMF Redial, Memories
- 350 mW Audio
- Selectable DTMF Speed
- Built-in PL Encode/Decode
- 35 mA Current Drain

IC-4GXAT

- Same features as 2GXAT
- 440 MHz

IC-2GXAT-HP

- 2 M
- 7 W @ 13.5 V DC
- BP-174 Battery Pack (12 V, 600 mAh)
- AD-25 Battery Charge Adapter Incl.
- 40 Memory Channels
- 700 mAh Battery
- Auto Repeater Operation
- Tone Scan
- DTMF Redial, Memories
- 350 mW Audio
- Selectable DTMF Speed
- Built-in PL Encode/Decode
- 35 mA Current Drain

IC-T22A

- 2 M, 5 W @ 13.5 V
- 4.0 - 16 V DC Input (Charges Batt. During Op.)
- Auto Low Power/ Power Saver (15 mA Drain)
- Remote Control Mic (Opt. HM-75A)
- 40 Memory Channels w/Alpha Display
- Air Cloning
- VHF/UHF Air Band Rx
- Auto Repeater Func.
- Backlit Display
- Channel-only Display if Desired
- Die Cast Frame and Heat Sink
- Tone Scan (Opt. UT-84)

IC-T42A

- Same features as T42A
- 440 MHz

IC-T21A

- 2 M
- 6 W @ 13.5 V DC
- Bonus Receive Band (2 M or 440 MHz)
- 6 Hours Operating Time
- 114 Memory Channels
- 33 Channels/Sec Scan
- Auto Low Power
- Full Crossband Duplex
- Battery Capacity Indicator
- Selectable DTMF Speed
- Auto Repeater Shift
- Tone Scan Built-in
- Backlit Keyboard

IC-T41A

- Same features as T21A
- 440 MHz

IC-V21AT

- 2 M/220 MHz
- 5 W @ 13.8 V DC
- Rx Two Signals on Same Band
- Built-in Pocket Beep, Pager
- Built-in Code, Tone Squelch
- Repeater Quick Memory
- Backlit Keypad
- Auto Output Power Control
- 900 mAh Battery
- 70 Memories
- Whisper Mode (opt)

IC-X21AT

- 440 MHz/1.2 GHz
- Bonus 2 M Receive
- 5 W (440 MHz), 1 W (1.2 GHz)
- 70 Memories
- Built-in Pager, Code Squelch
- Built-in Pocket Beep, Tone Squelch
- Repeater Quick Memory
- Auto Power Output
- Whisper Mode (opt)
- 900 mAh Battery
- 5 Power Levels
- Backlit Keypad

IC-W31A

- 2 M/440 MHz
- 5 W @ 13.5 V
- Remote Control Speaker Mic (Opt. HM-75A)
- 100 Memories with Alphanumeric Display
- Alphanumeric Message and Paging
- Backlit Display & Keypad
- Independent Tuning Knobs
- Long Operating Times (Power Saver and 700 mAh Battery)
- V/V, V/U, U/U Operation (Simultaneous Receive)
- External DC (4.0 V - 16.0 V) Charges Battery During Operation
- Auto Repeater Functions
- CTCSS Encode Stnd. (Decode Opt. UT-93)
- Tone Scan (Opt. UT-93)
- AM Aircraft RX

IC-Z1A

- 2 M/440 MHz
- 5 W @ 13.5 V
- Detachable Remote Control Speaker/Mic Standard with Full Functional Control and Dual Band Display
- 100 Memories with Alphanumeric Display
- Alphanumeric Message and Paging
- Backlit Display and Keypad
- Independent Tuning Knobs
- Long Operating Times (Power Saver and 700 mAh Battery)
- V/V, V/U, U/U Operation (Simultaneous Receive)
- Tone Scan (Opt. UT-93)
- AM Aircraft Rx
- External DC (4.0 V - 16.0 V) Charges Battery During Operation
- Auto Repeater Functions
- CTCSS Encode Stnd. (Decode Opt. UT-93)

IC-∆1A

- 2 M/440 MHz/1.2 GHz
- 5 W (2 M), 5 W (440 MHz), 1 W (1.2 GHz)
- 3 Independent Bands
- Simultaneous Receive
- 3 Independent Displays
- Crossband Double Duplex
- Programmable Digital Squelch
- Speaker Selection
- 78 Memories
- DTMF Encode/Decode
- PL Encode
- Clock
- 1200 mAh Battery

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DR-150T

FULL ACCESS MOVES YOU AHEAD

Engineered for Satisfaction. Alinco's DR-150T sets a new industry standard for 2 meter mobiles, featuring up-to-the-minute technology and a full-powered 50 watts.
So advanced and yet so simple to use, the DR-150T will more than satisfy the needs of beginners and Ham veterans alike.

Channel Scope Sweep Scan

Enjoy visual scanning capability of multiple frequencies along with simultaneous receive audio!!!

While in the channel scope mode, activate the scan function and quickly access only those frequencies that show a strong signal indication. The DR-150T's "S-meter" squelch control has 8 adjustable settings for custom operation. With the DR-150's built-in band scan, program scan and memory scan modes, the radio may be set to stop on either a busy or a vacant channel. Also, the DR-150T gives you a visual display confirming the direction of the scan, a feature which adds to the overall user friendly construction that this rig has to offer.

New Safety Dialer

Alinco has specially designed the DR-150T for mobile-safe operation. The new Safety Dialer feature enables the operator with complete control of auto dial transmissions simply with the equipped remote mic. Depressing the PTT in conjunction with either the up / down buttons gives you simple and direct access preventing any distraction while driving.

Features

- ✻ Frequency Range
- ✻ Receive: 108.000 – 173.995 MHz (AM, FM)
  440.000 – 449.995 MHz (FM)
  Transmit: 144.000 – 147.995 MHz (FM)
- ✻ Power Output
  High: 50 W, Medium: 25 W, Low: 10W
- ✻ Remote Control by Microphone
- ✓ Channel Scope (Visual Search)
- ✻ Various Scan Modes
- ✻ 100 Memory Channels plus 1 Call Channel Memory, 1 Program Scan frequency Memory
- ✓ LITZ Function Capability (The US First Emergency Alert Monitoring Feature)
- ✻ S meter Squelch Function
- ✻ Tone Burst Function
- ✻ Built in RF attenuator
- ✻ Built in 9600 bps/Phone Patch Interface
- ✻ Built in Tone Encoder (50 Tones)
- ✓ Safety Dialer (5 memory channels)
- ✻ DSQ Function
- ✻ Direct Frequency Entry from the DTMF microphone
- ✻ DTMF tone decoder
- ✻ 2 VFO's (A&B)
- ✻ TOT (Time Out Timer)
- ✻ Channel Display
- ✻ Tone Scan Function
- ✻ Air Clone
- ✻ Cable Clone

✓ NEW INNOVATIVE FEATURES

NEW

Size: 5-1/2" W x 1-9/16 H" x 6" D

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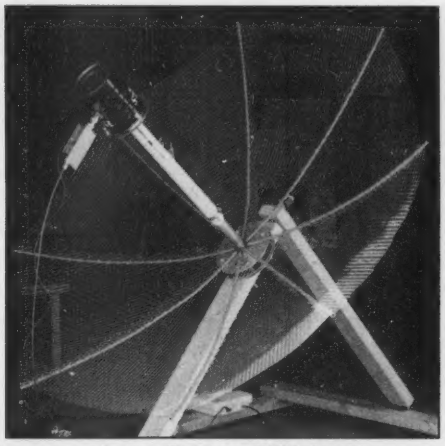

Wanna receive great weather satellite images? It'll help to have a good dish antenna, plus a low-noise amplifier. Build 'em both and save big bucks. Jim Kocsis shows you how in his articles beginning on pages 10 and 20.

On the cover: Although it's built like a tank and crawls through the desert (and even resembles a WWII German helmet), this desert "fox" isn't Field Marshall Rommel. This li'l guy is the "fox" in a radio foxhunt, or perhaps the "T" in a T-hunt. This month's "Homing In" column focuses on the fun you can have tracking radio-tagged wildlife.

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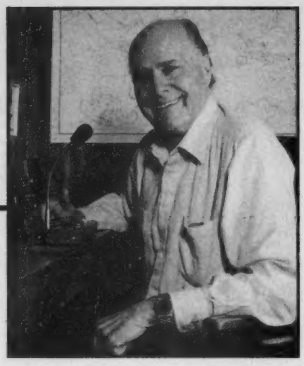
Contract: You know the drill—you look here, you're committed. It's that simple. You're hereby legally and morally bound to find ways to be found. Make it easy for prospective hams to reach you or your club for info and help getting into amateur radio. Run classified ads, post on local bulletin boards (the supermarket kind or the computer kind), write a weekly/monthly piece for your local paper . . . be creative. (And when something works, tell us here at *73* so we can share with others.) It's "the law." And it's also a good idea!—Nuge WB8GLQ

NEVER SAY DIE

Wayne Green W2NSD/1



My Dayton Talk

I know you aren't going to believe this, but for the second year in a row the Dayton HamVention program chairman didn't think it would be worthwhile to have me talk. Tsk. I'll bet three or four hundred hams stopped by the *73* booth and asked when I was speaking.

Well, I figured that might happen, so just before I went to Dayton I made a 90-minute tape of what I probably would have talked about if I'd have been asked. I took along a few dozen copies and offered them for $5 each. They sold out in short order. Most of the things I talked about on the tape are the same as I've been writing in my editorials, but perhaps embellished somewhat. As long as my editorials are, and they're the longest in the entire magazine publishing world as far as I know, they are generally as short as I can make them and still get my ideas across.

If you're interested in some good snooze material, send $5 to Uncle Wayne's Bookshelf for a copy of my Dayton nontalk.

The initial response to the tape from those who suckered into buying it at Dayton has been good enough to encourage me to turn on my tape recorder again and pontificate at length on more items of marginal interest. Well, I'll get to that as soon as I finish answering the mail piled up on my desk. My recent trip to Monaco (3A/W2NSD) for the cold fusion conference, followed by the Dayton trip, backed things up for me. Plus it's getting down to the last minute for producing the next issue of "*Cold Fusion*."

If you buy the tape for your club you could break it into nine ten-minute talks. That'll last you most of a year! Or you could play it in your car and fall asleep at the wheel. Or you could play it over your repeater and bum everyone out.

Even better, Glenn Baxter stopped by the booth and asked if he could interview me for his ham broadcasting service which is heard endlessly on all bands. Figuring he'd do the usual five minute interview I saw no great harm in that. Little did I know that he would tie me down (or was it up?) for about two hours. But then we were talking about me, my all-time favorite subject, so the time almost flew. But not quite. Now I won't have to write that biography so many people have been asking for. Lord knows what he'll do with all that stuff. Maybe he's going to go to a 24-hour a day schedule of broadcasting.

Glenn didn't ask me (but many others did) about my thoughts on the Maia petition to the FCC to end ham broadcasting. My answer to those who asked was the same one I've given most hams when they ask about FCC petitions. Don't ever ask the FCC for restrictions because the chances are that they will oblige, only with ten to a hundred times more than you asked for. The FCC has not, in my memory, managed to break our government's basic rule: Never do anything right.

"I've made it abundantly clear that I am no fan of ham broadcasting. But I'm even less of a fan of asking the FCC to improve our hobby with more restrictive regulations."

I've made it abundantly clear that I am no fan of ham broadcasting. But I'm even less of a fan of asking the FCC to improve our hobby with more restrictive regulations. The fundamental FCC rule is that if something is not prohibited, it is permissible. Secondly, we brag about being self-regulating and self-policing. Okay, let's see some substantiation of this. And if the ARRL, our only real national organization, isn't cooperating in helping to solve our problems, then give 'em hell until they do. The League is like any other bureaucracy, they move only when blasted by a car bomb or something. About the only way you can get their attention is by holding back your membership for a while. Of course, then they might do as they did the last time this happened, and overreact. The last time their membership started to fall off they decided to attract attention by proposing what was laughingly called their "Incentive Licensing" proposal. That's the one that put over 700 ham dealers out of business in one year and 90% of the manufacturers within three years. Talk about a killer proposal! Well, it sure did attract attention.

So, until you can figure out some way to turn Baxter and his broadcasting system down, the odds are that you're going to have to listen to a lot of Wayne Green emanating from Maine. My apologies to the hundreds of hams who stopped at my booth to say hello and found me tied up being interviewed. And interviewed. And interviewed.

Speaking of booth visitors, I do want to thank the hundreds of readers who stopped by to say they're enjoying the magazine. Even my editorials. I'll have to write some more, I guess.

Pregnant Hams

Judging by the hams passing my booth at Dayton, at least 30% are pregnant. Some alarmingly so. I saw hundreds of hams who appear to be at least eleven months pregnant. Mountains of stomachs going by. Well, looking on the bright side, no one was smoking. Inside, at least.

Look guys, I know what fat is all about. I spent a big part of my life being fat. Well, fairly fat, not gross. I varied from 225–250 pounds for years. Then, pardon the expression, I got fed up. I decided about twenty years ago that I'd had enough of being fat. I know what it feels like to want fattening food. To want ice cream, cake, pies, and fries. I know how hard it is to pass up the rolls and butter in a restaurant. After all, you're paying for them, so you'd better eat 'em, right?

Well, I watched these man-mountains waddling by. Hundreds of them. Thousands. Monuments to beer, chips, desserts, Big Macs, Whoppers, and so on. I watched thousands of hams who are substantially shortening their lives besides looking awful. Sure, I've been there, done that.

Contrast that to the endless comments on how good I look now that I've got my weight down. Many compliments. Oh, I still eat ice cream, but only now and then. I get out for a two-mile jog every day and I eat a lot of fruit and veggies, plus a little meat. When Sherry and I go out to eat we order one dinner and two forks. And we often still have leftovers to bring home.

How to lose that weight? That takes one of the most difficult things there is: you have to make The Decision. Once you've decided that you are going to diet and that nothing in the world is going to stop you, you're on the track. There are no secret diets. You just cut back your calories and never go over. No pills. No fat farms. For my size frame I found a 1,500 calorie diet was just right. You don't want to drop more than a couple pounds a week or you'll be chancing a heart attack or something. Take it slow and easy. You spent years building up that gut and it's going to take a few months to get rid of it. Forever.

You'll want to exercise. The best way is to start walking. Take it easy at first and gradually speed up to where you are either walking very fast or jogging a couple miles a day. Walking is better for you, actually. Less strain on the knees.

I took off 85 pounds over about ten months. Once you get used to operating your system on 1,500 calories you won't feel hungry. And once you've made up your mind not to eat junk food, you won't be bothered by it. The mind may call out for candy, but your mouth will do fine on carrots. You'll get to love salads with low-cal dressings. I chop up a head of lettuce, a pound of spinach, a handful of golden raisins and a handful of little pieces of Baby Swiss cheese in a huge bowl, mix it all up, and then keep it in a plastic grocery bag in the fridge for several days, eating a plate of it for lunch every day. I like the low-cal ranch dressing. A couple tablespoons well mixed into the salad at the last minute really tastes great. It's healthy and not fattening. And it's easy to fix.

Once you've dumped all that lard you want to be sure not to put it all back on again, like most dieters do. This means watching your weight. I went from 250 down to 165 pounds, so whenever I find I'm getting back up to around 175 I diet again until I'm down to about 155. It's very helpful if you invest in one of those doctor's scales with the balance beam. This lets you weigh yourself to the nearest quarter pound, thus giving you good feedback every day on your progress.

A lot of the visitors to my booth said I'd helped them stop smoking. I'm glad to hear that. Most of my old friends who smoked are dead. Very few of my WWII submarine buddies that smoked are still alive to come to reunions. Of course, it may be that you don't enjoy life enough or have any goals for hanging around. I do. I have so many things that I want to do that I don't have time to die. If I'm going to keep pushing new technologies with magazines I need to be around for at least another 20 years.

Continued on page 74

CH-32
Miracle Baby
146/446MHz
HT Antenna
Gain: 0dBi
Length: 1.75"
Conn: BNC

NEW Z750 • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: Gold-plated PL-259 • Max Pwr: 200W

NEW Z780 • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
146MHz 6/8 wave 4.5dBi • 446MHz 5/8 wave x 3 7.2dBi • Length: 62" • Conn: Gold-plated PL-259 • Max Pwr: 150W

FJ-15S • Tri-band 52/146/446MHz w/fold-over
Gain & Wave: 52MHz 0dBi 1/4 wave • 146MHz 4.5 dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W

SB-7/SB-7NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: SB-7 PL-259/SB-7NMO NMO • Max Pwr: 70W

SB-5/SB-5NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.5dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 3 • Length: 39" • Conn: SB-5 PL-259/SB-5NMO NMO • Max Pwr: 70W

CX-224/CX-224NMO • Tri-band 146/220/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 220MHz 3.5dBi 5/8 wave • 446MHz 6.0dBi 5/8 wave x 2 • Length: 36" • Conn: CX-224 PL-259, CX-224NMO NMO • Max Pwr: 100W

B-20/B-20NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.0dBi 5/8 wave x 2 • Length: 30" • Conn: B-20 PL-259/B-20NMO NMO • Max Pwr: 50W

SH-55 • Super Flexible 146/446MHz HT Antenna
Gain: 146MHz 1.5dBi • 446MHz 3.2dBi • Length: 15.5" • Conn: BNC • Max Pwr: 10W

B-10/B-10NMO • Dual-band 146/446MHz cellular look-a-like • Gain & Wave: 146MHz 0dBi 1/4 wave • 446MHz 2.15dBi 1/2 wave • Length: 12" • Conn: B-10 PL-259/B-10NMO NMO • Max Pwr: 50W

• Gold Plated Connectors
• High-Quality Craftsmanship
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COMET Specializes in a wide assortment of Mobile Mounting Systems that require NO HOLES. A variety of trunk lid, hatchback, rain gutter, roof rack and window mounts are available along with low loss coax cable assemblies, for the ultimate mobile station!

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LETTERS

Number 2 on your Feedback card

From the Ham Shack

Howard White VE3GFW Well, after reading your editorials for almost 30 years, I am surprised to have to admit that you are getting old and finally letting technology get ahead of you.

Snail Mail, indeed. How could anyone so progressive as you fail to capture the essence of the now medium of communication—E-mail? It works. It's cheap. It's accurate. It's efficient. It's easy to use. It's reliable. It's available to everyone. More important, it opens up a completely new medium of communications.

"E-mail? It works. It's cheap. It's accurate. It's efficient. It's easy to use. It's reliable. It's available to everyone. More important, it opens up a completely new medium of communications."

You probably recall Marshall McLuhan's "the medium is the message" theory. E-mail is essentially a completely new and different means of communications. In my long experience with it, I find that E-mail captures the essence of efficient communications that the ARRL (maybe even the "Pony Express") originally tried to achieve. Except E-mail works and it's reliable. For me, E-mail allows me to communicate with members of my family who are scattered around the world. I have made many new friendships with relatives whom I have never met or spoken to. One of my cousins has just written a book because of an inspiration I gave him through E-mail. Yet I have never spoken to him or seen him in person. I could never have achieved this level of communications with ham radio. As you have preached so long, the elitist and self-destructive policies that prevented access of the younger generations to ham radio have finally achieved their unspoken goals. Ham Radio as I knew it is dead, but not yet fully buried. My children will not ever be hams. Yet they are totally computer literate. With tools such as E-mail and the various chat features they can achieve much of the same communications functions that I used in ham radio. With cellular modems, they have the same flexibility to go mobile without the unreliability of ham radio. Please get an E-mail address. It is a real pain the butt to use snail mail and faxes.

***Howard,** my E-mail QTH is ProFusion@AOL.com. I don't encourage its use because it's slower than fax to reach me. Fax is the closest service we have that compares with RTTY in delivery . . . and I was doing that back in 1950. Yep, 45 years ago anyone on the net could send a message to anyone else. It would automatically turn on my printer when it was addressed to me and print it out. Then it sent a roger to the sender to confirm reception. Oh, I did E-mail personally for a while, but I found that it encouraged chatting rather than meaningful communications. I don't need pen pals. That's like sitting at a bar talking with people. My wife Sherry handles my E-mail for me. She enjoys AOL and Prodigy and I get the printouts. I feel sorry for the people who spend hours a day fighting small battles with small groups via the online services. I get the ham and cold fusion stuff, but seldom bother to enter the fray.*

One thing your kids won't get from their computers is the incentive to learn about electronics and radio theory. Can they design and build a circuit for their computers? They'll be doing the equivalent of standing on the corner chatting with people about little and missing the excitement of communicating through a ham satellite to someone in Russia, or snagging a voice contact with someone in Lesotho (where my call is 7P8CD) and finding out about what's going on there. Like the ham who has a small deer as a house pet. Or the fun of building a one-watt CW rig and working someone in Australia with it. Sure, tell me about E-mail.

Wayne

J. Frank Brumbaugh KB4ZGC I have been reading quite a bit in the ham magazine "Letters" columns wherein hams (?) mouth paeans upon Internet as making QRM/QRN-free QSOs with people all over the world. All one needs is a telephone, a modem, a computer, a monitor, and possibly a printer.

The cost of the necessary equipment probably equals, and in some cases, exceeds, the cost of the average ham radio station. But if all one desires is to be able to have QRM/QRN-free conversations with persons all over the world, all he *needs* is a telephone!

While I agree that Internet, if one has the knowledge and equipment for access, can be a wonderful source of knowledge, and does allow "teletype type" conversations—QSOs—without interference. But where is the challenge?

I like ham radio for the challenge, because there *is* QRM and QRN and QSB, and because propagation is so variable. One never knows whom one might contact, nor how interesting the resulting QSO may be. One reads the fist, or hears the voice, of the other party, and learns more about them than can be deduced from print appearing on a monitor. Ham radio is far more personal a communications medium than the Internet.

Perhaps because I've been a ham since 1949, and have designed and built a large number of rigs and accessories, plus modifying commercial equipment to make operation easier or better, I still enjoy the smell of hot solder, of designing or modifying and constructing accessories and test equipment. I also enjoy experimenting with antennas. All this fun goes out the window if one becomes simply a typist connected to the Internet.

I sit here typing this letter, which may or may not see publication. I am not having fun—that comes when I turn the rig on and explore the bands, usually trying to make a few contacts and hoping they will develop into more than a mere exchange of signal reports, rigs, and QSL promises; and many do. Fun, also, is when I open up the rig and add a modification or two, to make it serve me better. Fun is when I need a piece of test gear and design and build what I need, at a much lower cost than purchasing a commercial unit which, in all probability, has features I must pay for but lack the need for them.

Yes, Internet has its place, and one does not need a ham license to utilize it. But ham radio is not only a challenge but also is fun, and without both challenge and fun, life would be very dull.

I do not have a computer et al; I do not need them. I do have ham radio, both QRP and a 50-watt rig, and these I need! Enjoy Internet; I wish you well. But, please! Enjoy ham radio while we still have it.

"I still enjoy the smell of hot solder, of designing or modifying and constructing accessories and test equipment. I also enjoy experimenting with antennas. All this fun goes out the window if one becomes simply a typist connected to the Internet."

Edward Slabe N8TQP, Gahanna OH Wayne, I have been subscribing to *73* magazine for three years now, as long as I have been licensed. Each month I look forward to reading your editorials.

I have built many of the projects from your articles. You have a great magazine and it seems to be getting better all the time. Thanks!

I have read the book *Cross Currents* and found it thought-provoking and very informative. I have ordered the book *Kinship With All Life* and am waiting for it to come.

Thanks again for the great articles that you provide in *73*.

Donn S. Fishbein, MD, N8UWD, Celina OH Wayne, I've enjoyed your column for years. While most of the questions you pose to us readers are imponderable, I can offer my answer to a few you asked in your October 1994 column.

We can retain memory because cells in the human central nervous system, unlike most other cells in the body, have virtually no turnover or ability to divide or regenerate.

What about that 90% of DNA that isn't "involved with the blueprints for the current model human being"? This is a tougher question, but part of the answer is that much of it is antiquated or "junk" DNA that remains from evolutionary development. At a cellular level, it's much easier to switch a gene off than to delete the entire DNA sequence.

Keith Barze W4TXK You do write great editorials! (However, I'm not sure they get much more response than mine.).

Hams are tough to "move," and as you predict, most old timers give it the ol' "I had to learn the code and take a bunch of tests to get where I am; so should everybody else!"

Only a few of the older—and quite a few of the newer—hams take the liberated view of no-code, single license (or 5 wpm, if necessary) . . .

I've enjoyed *73* since you started it—1969, wasn't it?—but must confess I'm enjoying *Radio Fun* very much! (Almost better than *73* right now.) But keep up your good work . . . I appreciate all you've done and are doing for ham radio! 73!

Larry Lane Although not a practicing ham, I've enjoyed *73* for several years. Unfortunately I believe ham radio is doomed. The precedent of auctioning the airwaves (or delivering them to your political supporters) has now been accepted. Your spectrum is too valuable to government and the global communications conglomerates.

It will not be a clean, quick kill. The spectrum allocations will be whittled away bit by bit. You'll find new fees required for specific frequency use, increasing fees for higher output levels, antenna permit fees, fees for mobile operation, and so on. If these actions don't entirely decimate the ranks, amateurs will be painted as a threat to national security due to the "unregulated" international nature of your communications.

Addition of a million or two new hams might slow, but not stop, the process. Ultimately we'll all be relegated to paying exorbitant fees to communicate on heavily monitored government/commercial links.

What the hell; count me in as the first of those million or two new hams. Now to find a V.E. in the area.

LOW NOISE RECEIVER PREAMPS

LNG-(*)

still only $59
wired&tested

FEATURES:
- **Very low noise:** 0.7dB nf vhf, 0.8dB uhf
- **High gain:** 13-20dB (depends on freq)
- **Wide dynamic range** - resist overload
- **Stable:** dual-gate GAS FET

**Specify tuning range: 26-30, 46-56, 137-139, 139-152, 152-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*) MINIATURE PREAMP

still only $29 kit, $44 wired&tested

- **Low-cost** MOSFET preamp.
- **Small size.** Only 5/8"W x 1-5/8"L x ¾"H.
- Nf 1.2dB vhf, 1.5dB uhf.
- Solder terminals for coax & pwr connect.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

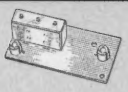
LNS-(*) IN-LINE PREAMP

ONLY $89 kit, $119 wired&tested

- **Automatically switches out of line during transmit.**
- GaAs FET Preamp with features similar to LNG series.
- Use with base or mobile transceivers up to 25W.

**Tuning range: 120-175, 200-240, or 400-500.*

HELICAL RESONATORS



Helical resonator filters may **reduce your intermod & cross-band interference.**

MODEL HRF- (*), *$59 vhf, $99 uhf.*

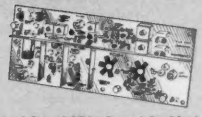
**Specify tuning range: 136-140, 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

Low noise converters to receive vhf & uhf bands on a 10M receiver.

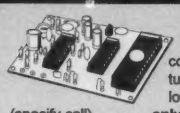
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (atv conv. to chan 3).
- **Kit less case *$49*, kit w/case & BNC jacks *$79*, w&t in case *$99*.**

TRANSMITTING CONVERTERS

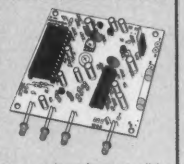


XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and atv. 1W output. **Kit only $89 (vhf), $99 (uhf).** *PA's up to 45W available.*

REPEATER CONTROLLERS



NEW! **CWID-2.** Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) ..... **only $54 kit, $79 w/t**



COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. .....**kit $99, w&t $149**

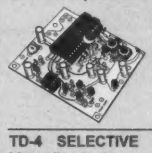
COR-3. COR, timers, court.beep .... **kit $49**

CWID. Diode programmable ..... **kit $59**

COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) .....**kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. .....**kit $59, w&t $99**



TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club. Also may be used to **control autopatch or other single device.** .....**kit $49, w&t $79**

TD-3 CTCSS (SUBAUDIBLE TONE) DECODER/ ENCODER ..... **kit $29, w/t $59**

AUTOPATCHES

AP-3 REPEATER AUTOPATCH. Reverse patch and phone line remote control. .....**kit $89, wired & tested $139**

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver. ..... **kit $39**

TD-2 DTMF DECODER/CONTROLLER. 16 digits, jumper-programmable, toll-call restrictor. Can turn 5 functions on/off. .....**kit $79, wired & tested $129**

DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver.....**kits $49, w&t $79**

9600 BAUD DIGITAL RF LINKS. Call for info on low-cost packet networking system: MO-96 Modem and special versions of our 144, 220, or 450 MHz fm xmtrs and rcvrs. Use directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

WWV RECEIVER

Get time and freq checks without buying expensive hf rcvr. Very sensitive and selective xtal controlled superhet, dedicated to listening to WWV on 10.000 MHz. ...**only $59 kit, $99 w/t**

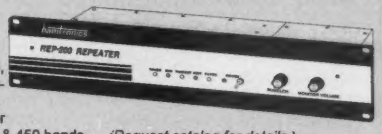
NEW!

You get more features for your dollar with our

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit still only $1095
w&t still only $1295
50 & 900 MHz bands slightly higher



- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!**.....**adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID.** .....**Kit only $795, w&t $1195**

REP-200N Repeater. Want to use your own controller? No problem! We'll make you a repeater with rf modules only. ..... **Kit only $695, w&t $995**

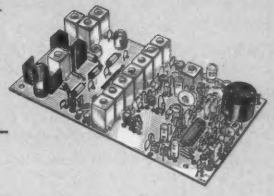
XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.
- **TA51**: 50-54, 143-174, or 213-233MHz.
- **TA451**: 420-475 MHz . *New low price!*

Either model: .....**kit $99, w/t $169.**
- **TA901**: 902-928 MHz, (0.5W out);

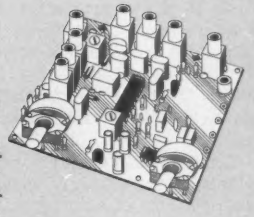
New low price! ..... **w/t $199.**



VHF & UHF AMPLIFIERS.
For fm, ssb, atv. Output levels from 10W to 100W. Models **starting at $99.**

FM RECEIVERS:

NEW! **R100 FM RECEIVERS** for 46-54, 72-76, 140-175, or 216-225 MHz. **Very sensitive –** 0.15uV, **exceptional selectivity –** both crystal & ceramic if filters for >100dB at ±12kHz (best available anywhere), **flutter-proof** squelch. .....*New low price!* **kit $129, w/t $189.**



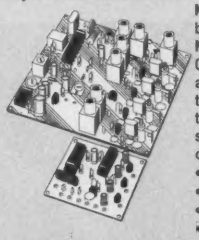
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. *New low price!* **kit $129, w/t $189.**
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion. *New low price*.... **$159, w/t $219.**

NEW! **R150 MONITOR RCVR** for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit,** easy to assemble and align.....**kit only $99, w/t $189.**

- **R120 AIRCRAFT RCVR** for 110-136 MHz ..... **kit only $99, w/t $219.**

WEATHER SATELLITE RECEIVER

NEW! **Our R138 Is The Most Affordable WeFax Receiver!**
We used our 30+ years of experience in designing high-quality vhf receivers to bring you this enhanced version of our long-popular WeFax Receiver, a very sensitive wideband fm receiver especially for amateur reception of NOAA and Meteosat weather facsimile images on the 137 MHz band. Use with demodulators and software from MultiFax, S.S.C., A&A Eng., and others. Features 0.2µV sensitivity, wideband filters for low distortion, and four crystal controlled channels at a fraction of the cost and complexity of synthesized units. Optional Scan Adapter allows you to automatically search for and record signals as satellites pass overhead while you are away from the shack.



- **R138 Receiver .....$129 kit, $189 w/t**
- **AS138 Scan Adapter.....$39 kit, $69 w/t**
- **Channel Crystals .....$12 ea**
- **ARRL Weather Satellite Handbook.....$20**

- Buy at low, factory-direct net prices and save!
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QRX . . .

Photo Search

Shoot our next *73 Amateur Radio Today* or *Radio Fun* cover photo! Suitable subjects might be ham gear, amazing antenna arrays, or better—your own catchy ideas. We prefer color prints (from 35mm or larger formats) that are vertically oriented, sharply focused, not too "busy," and (for *73*) leave extra room at the top and left side. Send 'em to *Photo Search, 70 Route 202N, Peterborough NH 03458,* with a brief description, your full name and callsign, and permission to publish. We can't return photos without an SASE. If it doesn't make the cover, we might find a spot inside. Selected photos earn you a free subscription or renewal. Good luck!

Dallas Hailstorms

Dallas County RACES sprang into action late on Friday May 5th as a series of ferocious hailstorms shattered windows, pockmarked cars, and collapsed buildings across the Dallas-Fort Worth area. Thirteen people are confirmed dead. Four others are missing and presumed dead and over 100 others were injured. The four missing people were apparently swept away in a storm drain in downtown Dallas.

As the storms approached, Dallas RACES went on tactical alert. The local Skywarn system was activated with hams feeding information to the National Weather Service in Fort Worth. Others provided police, fire, and emergency services with hail and flooding information.

Several ARES groups were also activated with at least one group of hams reportedly dispatched to the local Mayfest. Mayfest is an annual outdoor festival in West Fort Worth and many of the injured were attending this event.

Auto dealerships in the Dallas area reported damage to new cars from the hail that reached the size of baseballs. The Fort Worth police department's 45 brand-new cars were also damaged by the hail, which was accompanied by winds of over 70 mph and torrential rains.

Damage to the area was estimated at $250 million. The exact number of hams involved in this emergency operation is not yet known. *TNX Newsline.*

Wayne and Sherry at Dayton, 1995

OK, who else has been exhibiting since 1955? *TNX Bill Brown WB8ELK.*

Details on HF Data

As reported last week, the FCC has released its Report and Order in PR Docket 94-59, concerning HF digital communications in the Amateur Radio Service. The new rules, effective July 1, 1995, permit automatically controlled HF RTTY and data stations to communicate with one another in the following segments: 28.120 to 28.189, 24.925 to 24.930, 21.090 to 21.100, 18.105 to 18.110, 14.095 to 14.0995, 14.1005 to 14.112, 10.140 to 10.150, 7.100 to 7.105, and 3.620 to 3.635 MHz.

The new rules also permit manually controlled stations to initiate communication with automatically controlled HF RTTY and data stations. In this case the automatically controlled station may use any frequency authorized for such emissions, but may occupy a bandwidth of no more than 500 Hz.

Automatic control must cease upon notification by an FCC engineer in charge that the station is transmitting improperly or causing interference to other stations.

The FCC said it recognized the concerns of those who opposed the proposal on grounds that such operation could interfere with other amateurs, but that it believed the provisions adopted would be adequate to minimize such interference. *TNX Newsline.*

Taxi Sats

Amateur radio satellite operators in Spain have asked that nation's telecommunications regulatory agency to stop taxi companies in Madrid from using the satellite frequencies for their communications. Illegal taxi communications are reportedly making ham radio satellite communications unusable in Spain and in other parts of Europe when the satellite is visible. The taxi services are not actually using the hamsats to communicate. Rather they are illegally operating their dispatch services on frequencies reserved for amateur radio satellite operations. Several European amateurs have offered ideas on how to deal with the problem, but government assistance has been very slow. *TNX Newsline.*

Omega Radio R.I.P.

Listeners to *Newsline* on the satellite-delivered program "This Week in Amateur Radio" were surprised last week when all they heard was dead air. This is because the Omega Radio Network, which provided satellite time for "This Week in Amateur Radio" and several other hobby radio shows has gone silent.

Steven Anderman WA3RKB and George Bowen N2LQS produce the show, and say that they are looking for a new satellite home for their program. In the meantime, they will be feeding it out on 160 meter AM using the facilities of Vern Jackson WAØRCR and his 160 meter Gateway Net. If you know of some inexpensive or free time on a C-Band geostationary communications satellite, please give George and Steven a call at (518) 383-3665. In our book, this is a very worthwhile service that deserves your support. *TNX Newsline.*

The *Ham Band* Tours America

Musicians Andrew Huddleson G3WZZ/OZ1XJ/3D2AH from Northern England and his XYL Lissa Ladeforged from Arahus, Denmark, are touring America following their successful tape and CD recording of *Seek You,* a collection of country songs about ham radio they recorded in Nashville. They have recently toured Holland, Denmark, Hungary, Britain, and New Zealand. Andrew also operated from the rare DXCC island of Rotuma. Their recordings feature the skills of 15 of the finest Nashville musicians, including legendary pedal steel player Buddy Emmons, pianist "Pig" Robbins, and drummer Kenny Buttrey who played on Bob Dylan's Nashville albums. Shown in the photo are *Ham Band* members Andrew G3WZZ, his XYL Lissa, and one of the band's many fans, Ken Miller K6IR, of Rockville, MD. *TNX Ken Miller K6IR.* 73

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

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CIRCLE 159 ON READER SERVICE CARD

Dish Antenna for Weather Satellite Images

Build your own 5-foot parabolic dish for 1691 MHz.

by Jim Kocsis WA9PYH

My interest in weather satellite imagery started late in 1984 after seeing some pictures in *73* magazine[1]. Since then I've copied visible and infrared pictures from polar orbiting satellites (VHF) and all sorts of images via HF[2]. None of the pictures from those sources were as interesting as those I saw in articles showing images directly from the geostationary satellites. The polar orbiting satellite images don't display geographical borders[3] so you don't know exactly where the "weather" is located on your picture. The pictures from the geostationary satellites relayed over HF are fairly good, but: (1) the signal is subject to fading and static from man-made sources and thunderstorms (when you need it most and when the most interesting images are being sent); and (2) cloud and infrared imagery is available only once in awhile, because they mostly send maps of temperatures, pressures, etc. I wanted the near-continuous imagery that is only available from the originating point. After acquiring a microwave downconverter at the 1994 Dayton Hamfest and doing a lot of research, I figured that a 5-foot dish should have enough gain for obtaining good solid signals on a reasonably sensitive LNA/downconverter/scanner combination.

Why build a parabolic dish antenna? Just being a ham, I'm interested in antennas. I've built some that worked quite well and some that didn't. Until now at least, all of them worked to some extent, since some of the desired signals are very strong. Since the signals from the geostationary weather satellites are usually weak, the antenna is a critical component, and must be designed and built properly. Commercially available dish systems cost several hundred dollars on up—this did not set well with my ham radio "upbringing," which says it is ham tradition to build rather than buy. A 5-foot diameter commercial, solidly made dish that I obtained for free didn't work at all (more on that fiasco later!). A loop yagi for this frequency costs $100+. One manufacturer of loop yagis said performance is only "good" with some of the best LNA/downconverters—he said a dish is the preferred approach. After considering all these factors (price, performance, nonavailability of a surplus dish with the correct curvature) and the desire to *build something*, I could see another project on the way!

Technical

For a given wavelength, the feedhorn has a minimum length and diameter. An excellent item to use for a feedhorn for 1691 MHz is a two-pound coffee can. Again ham tradition comes into play: a coffee can is free, so, for reasons of thrift (not cheap—just as Wayne Green says), you should use one. To obtain optimum performance the dish and feedhorn should be "matched." See Figure 1.) Now the problem: All references I could find said the feedhorn should illuminate the dish such that the signal at the edge of the dish is 10 dB down from the level at the center, but what *is* the illumination angle of a coffee can? Using a coffee can feedhorn at 1691 will provide an illumination angle of 122 degrees. (This critical information I didn't have at first). I figured I should build the largest dish that I could easily handle and that would provide a fair amount of gain (20-25 dB). The diameter and the illumination angle together determine the depth (curvature) of the dish. This curvature is also referred to as the f/D (focal length to diameter ratio). For a 5-foot diameter dish and an illumination angle of 122 degrees the f/D is 0.424 and indicates a relatively flat dish—deeper dishes have lower f/D ratios (0.3 or so). All the dishes I could find had f/Ds of 0.3. I used a coffee can feedhorn with a 0.3 f/D, 5-foot diameter dish and heard nothing. After carefully studying my first attempt I found that the feedhorn was grossly underilluminating the dish, resulting in only about 1/2 of the dish surface being used. According to several sources[4, 5] it is very hard to design a feedhorn that would fully illuminate a dish with an f/D of 0.3; however, a common approach is to use scalar rings[6]. Scalar rings are an add-on around the perimeter of a circular feedhorn that spreads out the "wavefront," increasing the illumination angle. At our frequency the scalar rings would be approximately 14 inches in diameter—this reduces the amount of area of the reflector that

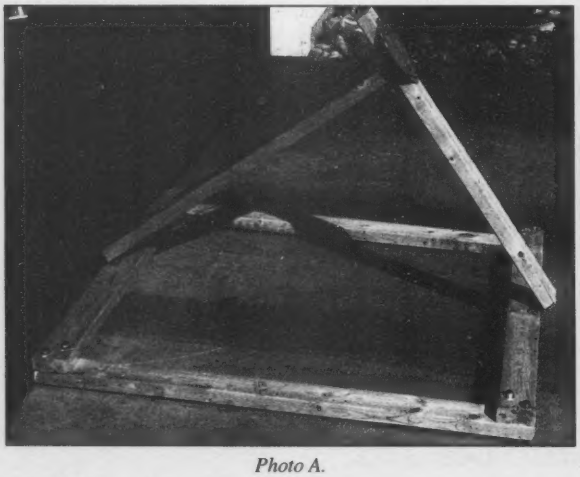


Photo A.

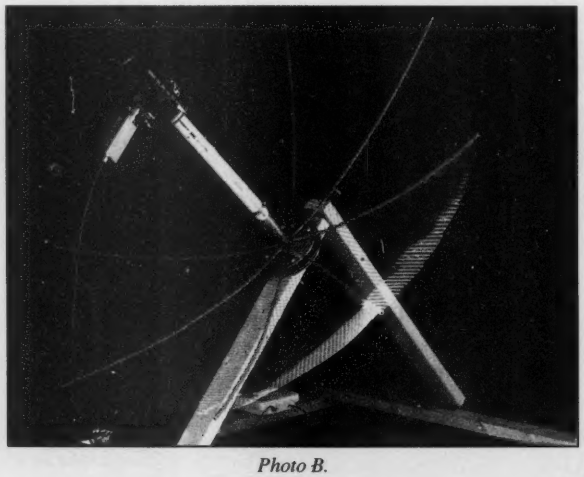
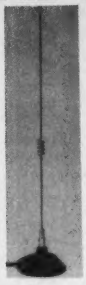


Photo B.

MFJ Dual Band Mobile Antenna



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Its tough *stainless steel* radiator is only 19 inches tall -- won't knock off when parking in your garage.

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DualBand144/440 MHz Ground Plane

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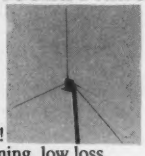
Dual band ground plane antenna for 2 Meters and 440 MHz gives you extra long range on 440 MHz with a high gain halfwave over quarter wave radiator. On 2 Meters you get solid quarter wave performance. Mounts on 1 to 1½ inch mast with single U-bolt. Easy-to-tune.

1/4 Wave Ground Plane

MFJ-1740 **$12.95**



The MFJ-1740 brings up 2 Meter repeaters as well as any ¼ wave ground plane made!

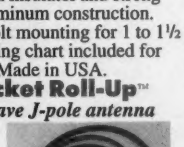
You get easy tuning, low loss ceramic antenna insulator and strong lightweight aluminum construction.

Single U-bolt mounting for 1 to 1½ inch mast. Cutting chart included for 220/440 MHz. Made in USA.

MFJ Pocket Roll-Up™

2 Meter halfwave J-pole antenna

MFJ-1730 **$14.95**



Roll up this *halfwave* 2M J-pole antenna and stick it in your pocket! It's the perfect *gain* antenna for traveling.

Get home station performance on the go. Just hang your *MFJ Pocket Roll-Up*™ in the clear and plug the BNC connector into your handheld.

It's omni-directional and has significant gain over a ¼ wave. It does not need a cumbersome ground plane so it's convenient for indoors and works great with handhelds. Made in USA

Dual Band *flexible* Ducks

144/440 MHz flexible ducks for HTs

A. *High Gain FlexiDuck*™, **MFJ-1717, $19.95.** Enjoy dependable QSOs when other rubber ducks give you noise. High gain ½ wave on 440 MHz, full size ¼ wave on 2M. Won't jab you -- bends, twists, flexes with you. 15¾ inches.

B. *FlexiDuck*™, **MFJ-1716,** **$16.95.** Similar to MFJ-1717. Full ¼ wave on 440 MHz, efficient loaded ¼ wave on 2 Meters. 8¾ inches.

Shorty Duck™ for HTs

Add this *short,* 4¼ inch *ShortyDuck*™ to your 2M handheld for a Q-5 signal! Impedance matched for maximum gain. High-Q helical wound radiator.

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You get low SWR so your rig can safely deliver maximum power into your antenna. It's rated at 300 watts PEP so you can use any mobile rig plus a mobile amplifier.

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Order MFJ-1728 with standard PL-259 coax connector or MFJ-1728B that also includes a BNC adapter for your handheld.

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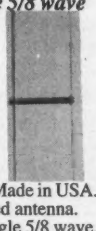
gives twice the omni-directional gain of a single 5/8 wave

MFJ-1764 **$34.95**



MFJ's stacked 5/8 wave radiators give you *more than twice* the *omni-directional* gain of a single 5/8 wave radiator!

Wide 10 MHz 2:1 SWR bandwidth . . . excellent ferrite choke balun feedline decoupling . . . shunt choke for bleeding off unwanted static . . . strong lightweight aluminum.

Fully assembled -- simply attach radiators -- no tuning required. Mounts vertically for FM/Packet or horizontally for SSB. Installs with single U-bolt on 1 to 1½ inch mast or tower leg. 1½ lbs., two 47 inch radiators, 23 inch boom. Made in USA.

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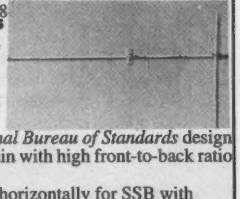
MFJ *dual band* 144/440 MHz Yagi

5 elements on 440 MHz . . . 4 elements on 2 Meters . . .$49.95

MFJ-1768 **$49.95** *New!*



Get two Yagis for the price of one . . . enjoy two Yagis in the space of one with single coax feed!

MFJ's *exclusive* dual band balanced feed with *FerriteChoke*™ decoupling prevents pattern skewing and gives you low SWR.

The MFJ-1768 is based on the *National Bureau of Standards* design that's optimized for maximum forward gain with high front-to-back ratio and a clean symmetrical pattern.

Mounts vertically for FM/Packet or horizontally for SSB with single included U-bolt on 1 to 1½ inch mast or tower leg.

High strength 6061-T6 aluminum 5 foot, 1⅛ inch diameter boom. 2 pounds. Elements are electrically isolated from boom. Made in USA.

Portable 3 element Yagi for 2 M

MFJ-1763 **$39.95**

You can set up or take down MFJ's *portable* 3 elements 2 Meter Yagi in seconds! Elements simply screw into the boom.

You can take it with you wherever you go and have the "oomph" and directivity of a beam.

It's easy to store and sturdy enough to use as your home station antenna.

Mounts vertically for FM/packet or horizontally for SSB. *Center* or *end* mounts with single U-bolt. Great for packet/PacketCluster™.

It's compact 2¾ foot boom gives you a calculated gain within 1 dB of a four element Yagi with a boom nearly twice as long.

Extra thick elements maintain high gain and directivity over entire 2 Meter band. MFJ's *FerriteChoke*™ decouples feedline.

Elements and boom are made from strong lightweight aluminum and protected by MFJ's *Permanent Molecular Bonding Technology*™.

Weighs just 2 pounds. Boom is 30½ inches. Made in USA.

5/8 Wave Ground Plane

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For a low, low $19.95, you get a *high performance* 2 Meter 5/8 wave ground plane home station antenna -- you'll get the maximum gain of any single element antenna.

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A. B. C.

B. *Dual Bander*™ for 2 Meters and 440 MHz, **MFJ-1712**, $14.95. Got a new dual band handheld or separate units? One antenna fits all. It's a ¼ wave for 2 Meters and a ⅝ wave with gain for 440 MHz. 7¼" collapsed, 19" extended.

C. *Pocket Linear*™ ⅜ Wave, 2 Meters, **MFJ-1710,** $9.95. Carry this pen size antenna in your pocket like a ballpoint pen. When you're using your rubber duck, on the fringe and noisy, put on the *Pocket Linear*™, extend it to 24½" and carry on your QSO. Has pocket clip. 5¼" collapsed.

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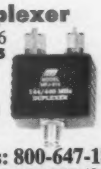

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```
10 FOR X = 0 TO 30
20 LPRINT X, (INT(10 * (( X * X ) / (4* 25.47 )))) / 10
30 NEXT X
```

X	Y
0	0
1	0
2	0
3	0
4	.1
5	.2
6	.3
7	.4
8	.6
9	.7
10	.9
11	1.1
12	1.4
13	1.6
14	1.9
15	2.2
16	2.5
17	2.8
18	3.1
19	3.5
20	3.9
21	4.3
22	4.7
23	5.1
24	5.6
25	6.1
26	6.6
27	7.1
28	7.6
29	8.2
30	8.8

"X" is distance in inches from center of pipe.
"Y" is amount of curvature in inches.

Table 1. X-Y coordinates of curve.

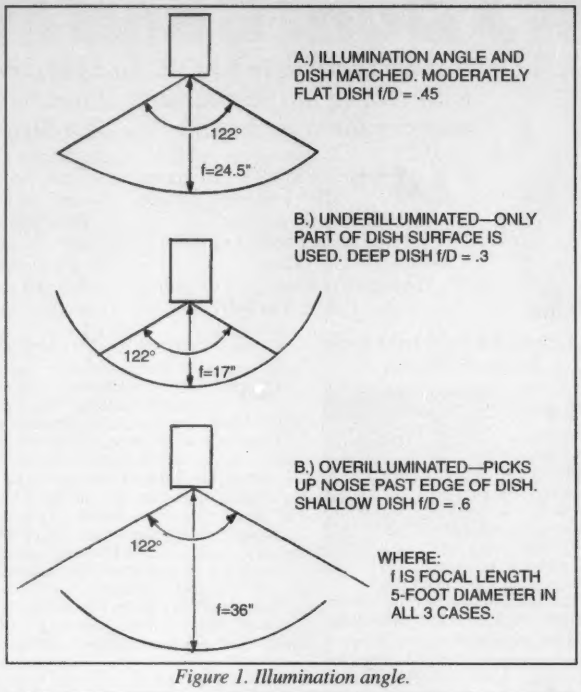
A.) ILLUMINATION ANGLE AND DISH MATCHED. MODERATELY FLAT DISH f/D = .45
122°
f=24.5"
B.) UNDERILLUMINATED—ONLY PART OF DISH SURFACE IS USED. DEEP DISH f/D = .3
122°
f=17"
B.) OVERILLUMINATED—PICKS UP NOISE PAST EDGE OF DISH. SHALLOW DISH f/D = .6
122°
f=36"
WHERE:
f IS FOCAL LENGTH
5-FOOT DIAMETER IN ALL 3 CASES.

Figure 1. Illumination angle.

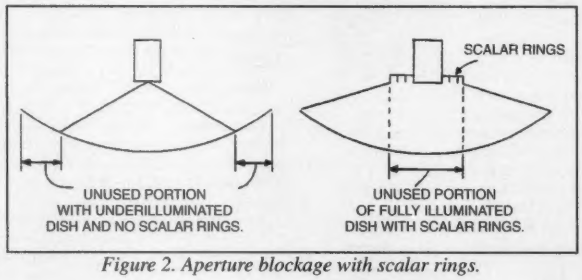
SCALAR RINGS
UNUSED PORTION WITH UNDERILLUMINATED DISH AND NO SCALAR RINGS.
UNUSED PORTION OF FULLY ILLUMINATED DISH WITH SCALAR RINGS.

Figure 2. Aperture blockage with scalar rings.

can "see the satellite." Using scalar rings presents the same problem as before: The entire reflecting surface is not being used. (See Figure 2.) (Scalar rings can be seen on lots of the TVRO dishes—look back into the feedhorn. They are the concentric rings around the opening of the feedhorn. They work well at TVRO frequencies [3.7-4.2 GHz] since they are very small at those higher frequencies and thus block very little of the reflector surface.) The bottom line: For a 5-foot diameter dish and an illumination angle of 122 degrees you need an f/D of 0.424 for optimum performance. See Table 2 for the method used to determine the curvature. Since I couldn't find a dish to meet these requirements, I decided to build one.

Construction Details

First gather all the parts you need (see the Parts List). The coffee can must have the dimensions shown. It *must* measure 5 inches in diameter and 6.5 inches long. There are some other sizes of two-pound (approx.) cans around; these will not work. The round aluminum plates and webs must have all the holes drilled accurately. (See Figures 3 and 4.) Next, make a fixture for bending the webs. Make up a small metal bracket that will secure the end of each web at the corner of the board so that webs attached to the bracket will be above the board surface by approximately 1 inch —this space will allow you to get the tubing bender between the board and the tubing when you bend the webs. (See Figure 5.) A curve is then drawn on the board that matches the required curvature of the reflecting surface. (See Table 1 for the X-Y points of the parabolic curve.) Make the bracket out of 1/8-inch or thicker aluminum or steel plate so the bracket doesn't move when you start the bending—you need a rock-steady anchor while bending the tubing. Make the first couple of inches of bend by hand, since the tubing bender won't be able to grip the tubing near the bracket. The remaining bends can then be made using the tubing bender. The two holes at the end of each web should be the smallest possible—these holes are *the* weak point in the entire design. I used 6-32 screws, but recommend 4-40 size hardware now that I have built the dish and see some ways to improve it. After mounting the webs to the plate, we need to convert the bending board to a template to see if the webs still conform to a smooth parabolic surface. Cut the board along the curve you used to guide yourself when you were bending the webs. A saber saw will work fine. Slide the template around the steel pipe and check the webs to see that they haven't been bent away from the parabolic curve. All webs should conform to a parabolic shape by plus or minus 7/8 inch.

Next, the individual panels must be cut from the metal cloth. Warning: *when you unwrap the metal cloth be careful that the roll doesn't spring apart and cut you!* It can injure you before you know what happened. I recommend a face shield, gloves, and a thick sweatshirt, which should protect you very well—safety glasses as a minimum. Also, keep children and pets clear of the metal cloth after it is unrolled. The garage is an excellent place to do all the cutting. Be careful, the edges you cut are sharper yet—my hands looked like I was wrestling with a jungle cat after cutting my first panel! The most important point is that you should cut each panel too large rather than too small—don't scrimp here! If you cut a panel too small you can't stretch it and you will have to throw it out (Wayne wouldn't like wasting *his* money would he?). Cut out a template, using heavy paper, to the dimensions shown in Figure 6. Lay this template on a flat portion of the

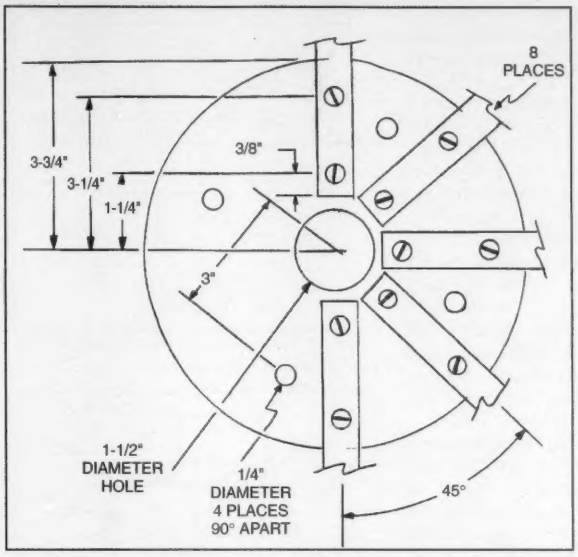

Figure 3. Front plate layout.

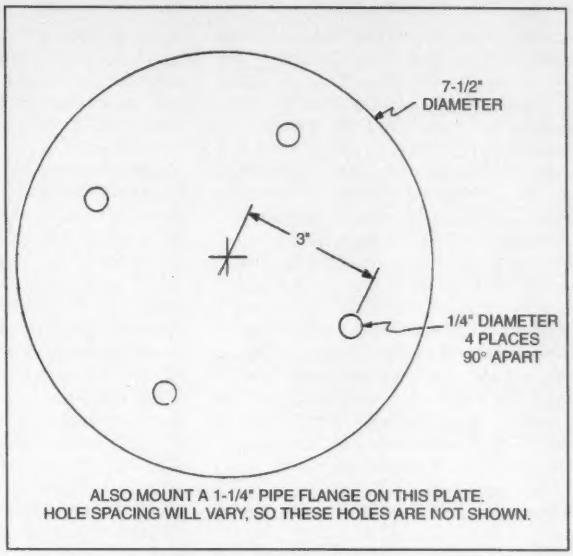

Figure 4. Rear plate.

metal cloth and cut it using side cutters. I cut the panels over several weeks. Since steel wire is much harder than the copper we are used to cutting, you will probably have blisters on your fingers after cutting two or three panels. Each panel should be curved to conform to the required shape *before* attaching it to the webs. If it is too flat you won't be able to stretch it to the required curvature. If it is too curved you can "pull it tight" to get the required curvature, so curve it a little too much instead of too little. Anchor each side of the panel at the unattached end of each web with a large alligator clip. Begin by securing the panel with 6-inch lengths of steel wire, passing the wire around the web, and a soldered junction that touches the web—this will prevent a junction from being pulled apart. (See Figure 7.) Twist the steel wire until the metal cloth is tight against the web, then cut it so that a few twists remain. Bend the twist down to get it out of the way. When doing the wiring, I hung the plate and web assembly from a shelf. I recommend this since it eliminates having to reach over the dish if you were to assemble it on the floor. (See Figure 8.) Hanging the dish as shown allows you to stand up or sit on a stool while attaching the panels. Continue adding steel wire until you have the panel secured every 2 to 3 inches along each web. The last panel is the hardest to wire since you won't be able to reach between any unpanelled webs, but by this time you'll be an expert! Most panels will need some pushing and pulling to get them within the ± 7/8-inch tolerance from the required curve. If a panel is so very curved *behind* the desired curve that you can't push it into shape, you may have to use another technique. The technique is simply to use a pair of large needle-nosed pliers to pull a panel "tighter." Grab each of the wires of a pane that goes side-to-side (web-to-web) and give it a 90-degree twist. (See Figure 9.) Once you get all the panels to within the ± 7/8-inch tolerance in most areas, you are done with the most difficult part. Deviations from a perfect parabola are preferably both plus and minus, and not progressively plus or progressively minus. (See Figure 10.) Next, mount the flange and its pipe at the center of the rear round plate, using some small bolts and nuts. There isn't much weight to support, so 8-32 size hardware is adequate. Next, bolt the two plates together using the 1-inch sections of tubing with 1/4-20 bolts passing through them. (See Figure 11.)

Next comes the construction of the feedhorn. (See Figures 12 and 13.) First, cut the copper tubing to the required 1.375-inch length. You may have to drill out the center of the tubing if you used a tubing cutter since the cutter tends to close off the tubing ID. Solder the tubing to the N connector center conductor—keep it straight and make sure you have a good, clean connection. Remove any solder on the outside of the tubing since copper is a much better conductor than solder at this frequency. Remember that *all* of the signal travels along the outside of this short length of tubing. Next cut a hole for the N connector in the side of the coffee can 3 inches from the closed end. The metal can is so thin that drilling is very difficult, so if you have or can borrow a chassis punch to make the hole for the connector, use it. If you cannot get a chassis punch, then drill a hole somewhat smaller than needed and file the rest. I tried drilling the hole the required size and ended up ripping the can so badly I had to discard it. After you have a smooth round hole, use a wire wheel to remove all paint on the outside of the can near the hole. Also clean up the edge of the N connector flange where it will be soldered to the can. Drill the four small holes in the can and mount the connector with four small bolts and nuts. Tighten the screws so the connector flange is tight against the can. Using a

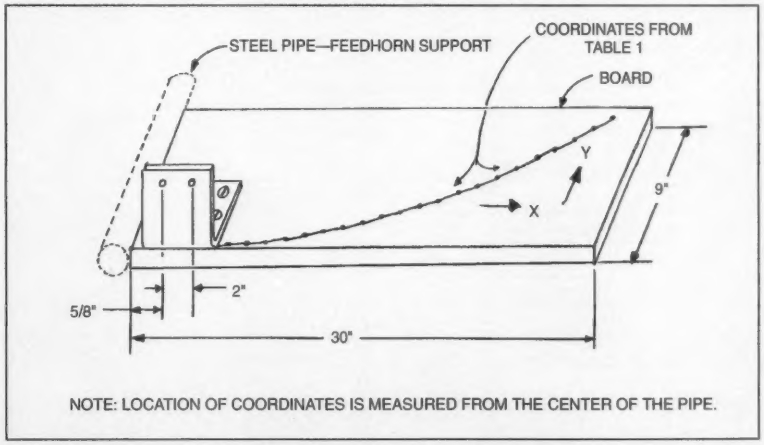

Figure 5. Web bending fixture/template.

propane torch, solder all around the flange so there is one continuous bridge of solder between the connector and the can. I used the rosin core solder that I use on all my electronic work, and some extra soldering paste to make sure that I had a good clean connection. Use alcohol to clean all the flux from the area after you are finished. Next cut the PVC pipe to a length of 19 inches. Make two cuts at one end, approximately 2 inches long, 90 degrees apart. At the end opposite the cuts, mount the nylon "L" brackets on the PVC pipe. The "L" brackets I used came from a tie strap use for cable bundling. They have an extra piece that is used to attach the cable bundle to a chassis with a small bolt. Cut and discard the tie strap. The round hole is used for attachment to the PVC pipe. The slot is used for attachment to the Plexiglas plate. (See Figure 12.) This method of supporting the feedhorn is a slight variation on a design described in the *Weather Satellite Handbook* by Taggart—I had access to nylon parts and used them. Slide the PVC pipe over the steel pipe and adjust it so that the edge of the can is 24.4 inches from the center of the reflector surface. (See Figure 13.) The focal length of this dish is 25.5 inches. The focal point is the location that all incoming energy is focused upon. This point should be 1.1 inches *inside* the can for best operation. Secure the two pipes together with a hose clamp.

I've included a diagram of a mount that I used to support my dish. It's simple, very inexpensive, and it works. (See Figure 14.) Attach the whole dish assembly and aim the dish at the desired satellite. GOES 8 is the best satellite to aim at since it is the newest satellite and is running full power. As of late December 1994, GOES 7 is running 1/4 power (a 6 dB disadvantage) and will be more difficult to receive full-quieting signals from when using a marginal system. GOES 8 is running vertical polarization, which means that the copper stub in the feedhorn should be pointing straight up or straight down. Since this dish has a beamwidth of 8 degrees, aiming isn't too critical. With my home-brew LNA, an unknown surplus downconverter and a scanner-type receiver, I was able to receive a full-quieting signal from GOES 8. The LNA isn't real "hot" (the noise figure is calculated at 1.7 dB and the gain was measured at 39 dB). Moving the feedhorn in and out or side-to-side 3 inches made no difference in the signal; it stayed full quieting. This shows that the system has plenty of reserve gain, but you should still adjust the feedhorn spacing for a peak. To peak the spacing, first reduce the signal level by turning the dish slightly to one side until the signal weakens. Then adjust the feedhorn spacing for a peak. Last, after perform-

1.) < BAC = 61° and < CBA = 90° therefore < BCA = 29° where < means "angle formed by ...."

2.) $\text{TAN } 29° = \frac{AB}{BC}$

3.) $.5543 = \frac{AB}{30"}$

4.) AB = 16.63"

5.) General Dish Formula: Focal Length = $\frac{(\text{Diameter})^2}{16 \times \text{Depth}}$

$f = \frac{D^2}{16d} = \frac{(60)^2}{16 \cdot d}$

Where D = diameter = 2 x BC
d = depth = BD
f = focal length = AB + BD

6.) $f \cdot d = \frac{3600}{16}$

7.) $f \cdot d = 225$

8.) But: $f = d + 16.63$
So: $(d + 16.63) \cdot d = 225$
$d^2 + (16.63 \cdot d) - 225 = 0$ Solve quadratic equation for d

General Quadratic Equation: $ax^2 + bx + c = 0$

Solution To Quadratic Equation: $X = \frac{-b \pm \sqrt{b^2 - (4ac)}}{2a}$

9.) $d = \frac{-16.63 \pm \sqrt{(16.63)^2 - (4 \cdot 1 \cdot (-225))}}{2 \cdot 1}$

10.) $= \frac{-16.63 \pm \sqrt{276.56 + 900}}{2}$

11.) $= \frac{-16.63 \pm 34.3}{2}$

12.) = + 8.835", – 50.93" (–50.93" is not possible so d must be +8.835)

Table 2. Calculation of parabolic curve.

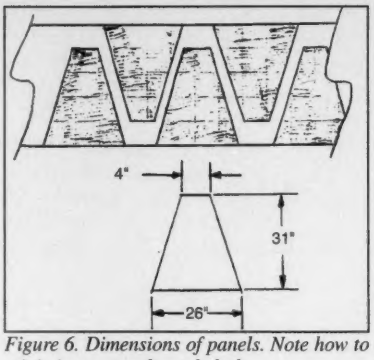

Figure 6. Dimensions of panels. Note how to minimize waste of metal cloth.

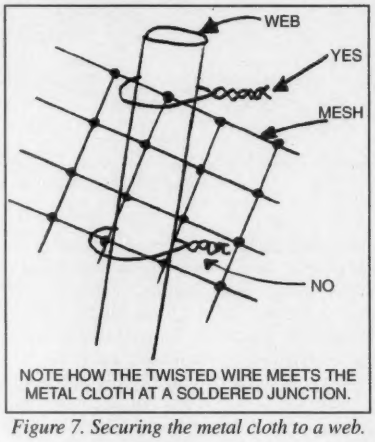

Figure 7. Securing the metal cloth to a web.

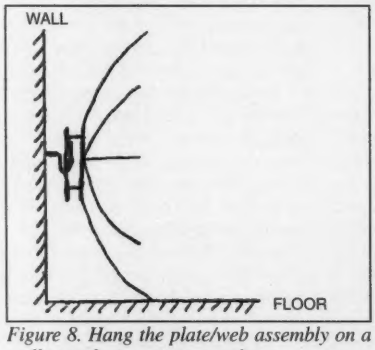

Figure 8. Hang the plate/web assembly on a wall to make it easier to work on.

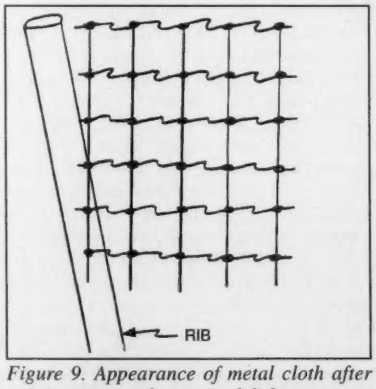

Figure 9. Appearance of metal cloth after twisting it to get the required dish curvature.

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What's in the Bucket?

Start with a 66-ft TNT Adventurer antenna and its mating silver-tipped 66-ft low band extension. Include 97-ft isolated RG-8x feedline with silver connectors. Pack it inside the QuickLaunch bucket containing everything you need to hang a wire and keep it there: fluorescent launch line, bright red reusable projectiles, safety cover, 200-ft spool of black UV-proof support line. Add detailed manuals. It's a complete system ready for adaptation to the circumstances of any situation.

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An Action Test

Put the TNT Grab-N-Go to the test like low-power enthusiast Bob Joiner, WB7BIV. Bob took one out into the western Oregon woods for field day. Using its launching system, 68 year-old Bob placed the antenna feedpoint at 75 feet. Then working the ends around the branches, he tied them off to form an inverted V. Fifteen minutes from go, he went on the air.

Over the next 24 hours, Bob operated 80, 75, 40, 20 and 15 meters. He contacted 196 stations across North America from one coast to the other, *using only 950 milliwatts of output power*—less than a pencil-sized flashlight consumes.

That's the bottom line: The TNT Grab-N-Go is not only quick to deploy, it gets the message out when the chips are down.

Readiness has a Payoff

You don't have to wait for disaster to enjoy the benefits of preparedness.

Picture yourself at the end of the day encamped in pine scented solitude while chatting with radio friends across the continent.

Visualize the warmth of the cabin fireplace as the sun sets on the ski slope and the cold winds howl in the chimney. Yet even here, you can communicate with the whole world as you wait for tomorrow.

And think of the fun of talking to the antipodes late into the night after a full meal of fish caught in a clear mountain lake.

All these early benefits of preparedness are more than pure enjoyment. They ensure that you really have what it takes to be of service when lives depend on it.

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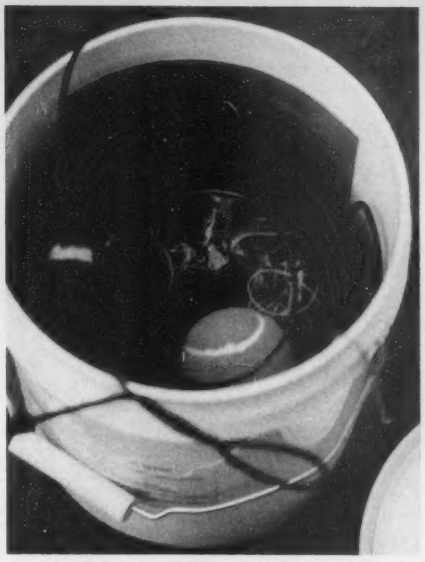

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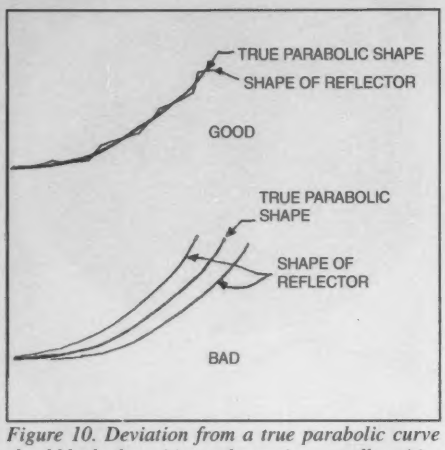

Figure 10. Deviation from a true parabolic curve should be both positive and negative, not all positive or all negative.

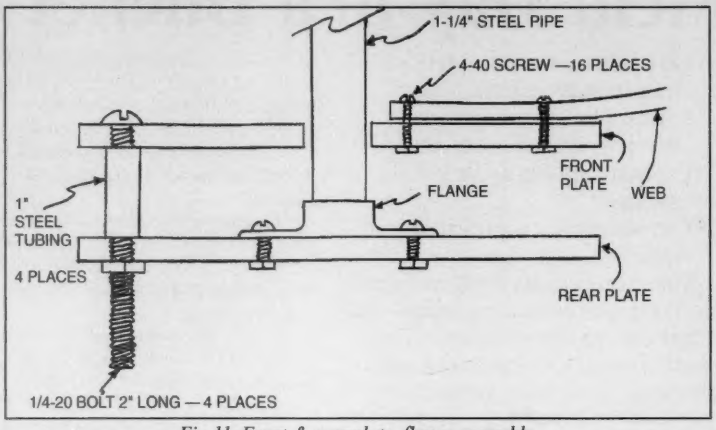

Fig 11. Front & rear plate, flange assembly.

ing all the tests, I noticed that half of the dish was "looking" through our garage overhang. We're not allowed to have satellite dishes in our neighborhood, so I did all my test "looking" out the overhead garage door. I plan on mounting this antenna completely indoors, so this was a good test, even though it was unplanned. The extra gain may be needed in my installation. The feedhorn is a generic design—I've seen it described in *QST*, the *Weather Satellite Handbook* (highly recommended reading!) and the *RSGB* handbook. The design of the dish is my own and can be changed as you see fit; just keep the curvature within the ± 7/8-inch tolerance. I'm not sure how long my dish would last outside—we occasionally have wind gusts up to 60 mph in our city, and I doubt this dish could withstand a wind that high. If I were to place this dish in "the elements," I would consider putting some kind of potting inside the webs to strengthen them. Also, you should consider drilling a small hole at the end of each web and passing a wire through all around for extra support of the webs. And spraying the entire dish with Krylon brand acrylic spray will keep the steel parts from rusting. (I've sprayed this on the galvanized steel parts of a telescoping mast, and 20 years later it still shows no signs of rusting!

Continued on page 18

PARTS LIST

Quantity	Description
1	1-1/4-inch pipe flange
1	1-1/4-inch O.D. pipe, 14 inches long
2	Aluminum plate, 7-1/2-inch diameter x 1/8-inch thick
8	Aluminum tubing, 3/8-inch diameter x 31 inches long, and a suitable tubing bender
16	4-40 nut, screw, star washer combination
4	1/4-20 x 2-inch bolt with nut
4	Steel tubing, 1/4-inch I.D. x 1 inch long
1	PVC pipe, 1-1/4-inch I.D. x 19 inches long
1	Pipe clamp, 1-1/2 inch
1	Plexiglas, 6-inch diameter x 1/8-inch thick
6	Nylon brackets (see text) from tie straps
6	Nylon bolt and nut, 4-40 x 3/4 inch long
1	Coffee can, 5-inch diameter x 6-1/2 inches long
	Flange mount type N connector (silver plate—*not* bright, shiny type!)
1	Copper tubing, 3/16-inch O.D. x 1-3/8 inches long
4	4-40, 1/2-inch bolt and nut—attaching N connector to coffee can
1	Roll of 1/2-inch metal cloth, 36 inches wide x 18 feet long
1	Roll of steel wire, #20, 50 feet
1	Piece of solid wood (*not* plywood), 3/4-inch x 9 inches x 31 inches
Mount	(optional)
3	Building grade 2 x 4, 8 feet long
	Hinges, wood screws as required
8	3-inch nail
1	Aluminum plate, 7-1/2-inch diameter with holes to match rear plate

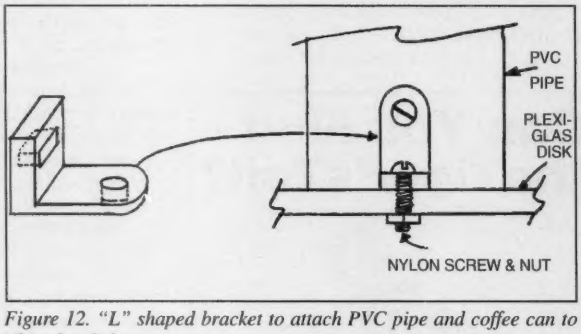

Figure 12. "L" shaped bracket to attach PVC pipe and coffee can to Plexiglas disk.

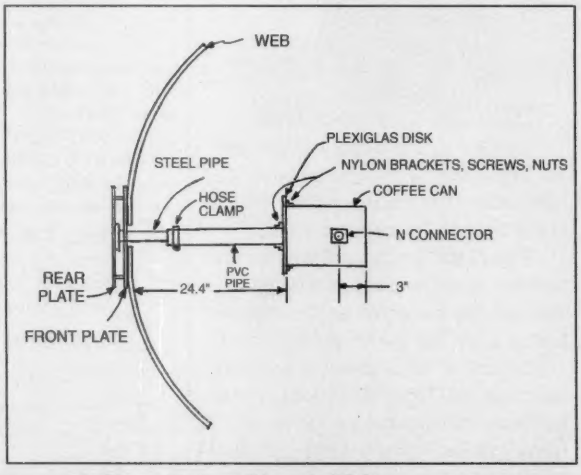

Figure 13. Overall layout of dish components.

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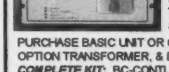

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Continued from page 16

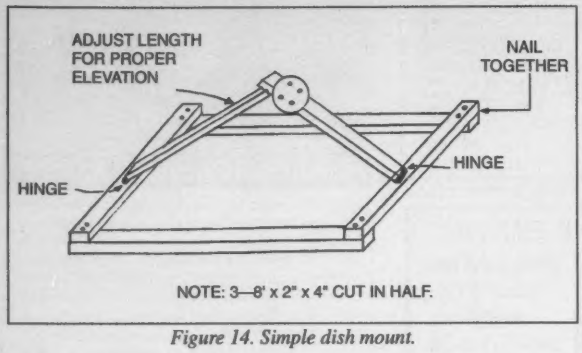

Figure 14. Simple dish mount.

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2. Using a SSB receiver tuned to 8.080, 3.357, etc., MHz.
3. There is some software available from OFS Weatherfax that does superimpose geopolitical maps on the picture data that you obtain from the polar orbiting satellites.
4. *Satellite Experimenter's Handbook*, ARRL publications.
5. *The ARRL UHF/Microwave Experimenter's Manual*, ARRL publications.
6. *Satellite Experimenter's Handbook*, 1985 edition, pages 9–30.
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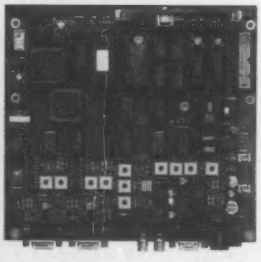
8. Other references:
   ARRL Antenna Handbook;
   The Weather Satellite Handbook, by Ralph Taggart (highly recommended reading);
   "Cylindrical Feedhorn for Parabolic Reflectors," *Ham Radio Magazine*, May, 1976;
   Technical correspondence, *QST*, March, 1980.

I learned a lot designing this dish. I especially appreciate the help of Norm WA9HUV and Bob WA7MOV, without whose help I could not have determined the proper illumination angle of the feedhorn, and thus optimized the curvature of the reflecting surface. Copies of all my notes are available if you send a large SASE with enough postage for 4 ounces. The techniques I used came from the sources shown, but I combined the best of each to design an antenna that is lightweight, easy to produce and provided the maximum amount of gain. The *Weather Satellite Handbook* didn't optimize the curvature of the reflecting surface by matching the illumination angle and the dish diameter. The article in *Ham Radio* magazine[7] required a fair amount of mechanical machining that I was not capable of doing myself.

The following people were very helpful while constructing the dish: Dave WD8CZM, for helping to verify the formulas; Roger WA9OKC, for general help on microwave techniques and requirements; Bob N9NRW, for cutting the Plexiglas plate on the feedhorn; George Pullin, for helping machine the round aluminum plates; and my Dad, for teaching me a long time ago to tackle a big project like this one piece at a time instead of trying to do it all at once. I highly recommend reading as many of the references listed as possible[8]. They were a real education for me. (A word for those of you who don't think you can successfully build a dish like this: How accurate does the surface have to be? You can deviate 1/8 of a wavelength [7/8-inch at this frequency] with no noticeable degradation in performance. Do you think you can hold this tolerance? Sure you can! Just take . . . your . . . time!). If you decide to build this dish, I would appreciate hearing from you on how it works!

REPEATER AND LINKING CONTROLLER THAT RECORDS AND SPEAKS YOUR LANGUAGE



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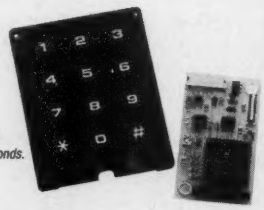
ID-8 Automatic Morse Station Identifier

Compatible with Commercial, Public Safety, and Amateur Radio applications. Uses include Repeater Identifiers, Base Station Identifiers, Beacons, CW Memory Keyers, etc. Great for F.C.C. ID Compliance.

- Miniature in size, 1.85"x 1.12"x 0.35".
- Totally RF immune.
- All connections made with microminiature plug and socket with color coded wires attached.
- CMOS microprocessor for low voltage, low current operation: 6 to 20 VDC unregulated at 6ma.
- Low distortion, low impedance, adjustable sinewave output: 0 to 4 volts peak to peak.
- Crystal controlled for high accuracy.
- Transmitter PTT output (to key transmitter while ID is being sent), is an open collector transistor that will handle 80 VDC at 300ma.
- Field programmable with SUPPLIED keyboard.
- Confirmation tone to indicate accepted parameter, plus tones to indicate programming error.
- All programming is stored in a non-volatile EEPROM which may be altered at any time.
- Message length over 200 characters long.
- Trigger ID with active high or low.
- Inhibit ID with active high or low. Will hold off ID until channel is clear of traffic.
- Generates repeater courtesy tone at end of user transmission if enabled.
- Double sided tape and mounting hardware supplied for quick mounting.
- Operating temperature range, −30 degrees C to +65 degrees C.
- Full one year warranty when returned to the factory for repair.
- Immediate one day delivery.

Programmable Features

- *Eight programmable, selectable, messages.*
- *CW speed from 1 to 99 WPM.*
- *ID interval timer from 1-99 minutes.*
- *ID hold off timer from 0-99 seconds.*
- *CW tone frequency from 100 hz to 3000 hz.*
- *Front porch delay interval from 0 to 9.9 seconds.*
- *CW or MCW operation.*



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- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
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- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

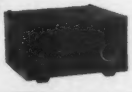
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

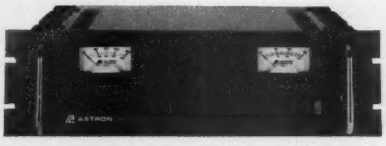
RS-L SERIES



- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

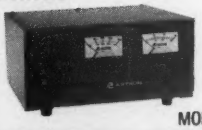
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

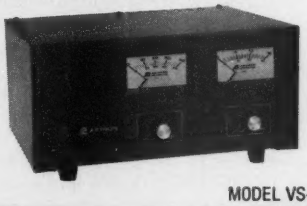
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

A Low Noise Amplifier for 1691 MHz

Build this LNA for weather satellite reception.

by Jim Kocsis WA9PYH

The signals from the geosynchronous weather satellites are very weak after traveling the 22,500 miles to earth. The satellites' transmitter power is only 5 watts—not a lot of power for the distance. The signal at ground level is on the order of 0.05 microvolts. Consider that your typical 2 meter rig has a sensitivity of 0.15 microvolts for a nearly full-quieting signal—the signal from a weather satellite is 1/3 this level and at a frequency approximately 10 times higher. High sensitivity at this high frequency is difficult to attain (read: expensive)—check the price of a typical LNA for this frequency—prices start at $150 and go up!

Sure, you can build one—but you must match the input and output impedances of the amplifying device (typically some kind of FET) to 50 ohms. The impedances are usually complex and thus will have capacitive and/or inductive components plus resistive components that must all be transformed to as near 50 ohms resistive as possible. This is so you can obtain the gain and noise figure the manufacturer of the device shows in his specifications. I spent literally months reading about "S" parameters, Smith charts, stripline matching networks, etc., that tell how to design the required matching networks. I even designed an FET-based LNA that was very complex—never tried it out, though. It required two power supplies: one for the drain and one for the bias supply for the gate. The power supplies had to be turned on and off in the correct order or else—POOF!—there goes the FET at $13!

At work I receive various magazines that advertise components for the commercial and military electronic markets. One component that caught my attention was a Low Noise Amplifier IC from MACOM for the Personal Handy Phone, PBX and Personal Communications Systems and Network markets. The stated frequency range of the IC is 1700–2000 Mhz, it has nearly 50 ohm input and output impedances, draws 20 ma from a single 5-volt supply, a gain of approximately 20 dB, and a noise figure (NF) of approximately 1.7 dB. All this for about $8.00 each in small quantities. Just what I was looking for! With two ICs I was able to attain 39 dB measured gain. The calculated NF is 1.706 dB. (I was not able to measure the NF, since no test equipment was available to measure this parameter. As a note, the NF of ready-made LNAs for this frequency do have a lower NF, but with a 5-foot dish I figured these ICs would work fine.)

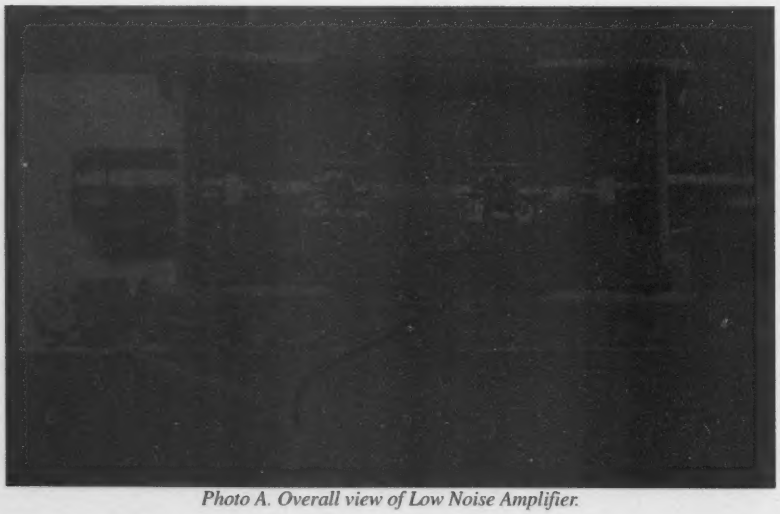


Photo A. Overall view of Low Noise Amplifier.

Technical

As shown in the schematic, the circuit uses two ICs and a few passive components. (See Figure 1.) The circuit comes from the manufacturer's data sheet. There are no matching networks and no bias supply. The ICs are surface mount packages, so be forewarned, they are very small. There are two versions of the IC: a lower-cost/higher-NF/higher-gain unit (the MAAM12031) and a (slightly) higher-cost/lower-NF/lower-gain unit (the MAAM12032). The 12031 has a 1.8 dB NF with 22 dB gain, the 12032 a 1.67 dB NF with 15 dB gain. The IC with the lowest NF is the first stage, followed by the higher-gain IC. (The first stage of a receiver should always be the lowest noise—it sets the sensitivity of the whole system.)

The 35-ohm resistor from pin 2 to ground is optional—it increases the gain by 2-3 dB and reduces the NF slightly, but also increases current draw from 8 ma to 20 ma per IC. Since we need more gain and a lower NF a lot more than we need low power consumption, we will use this resistor. In some handheld products (phones and such) you need as little current draw as possible from the small batteries used, so in these cases the IC would not use this resistor.

The track from the connectors to the ICs, and between the ICs, forms a 50-ohm transmission line. The thickness of the dielectric of the PC board, the type of dielectric (Teflon), and the width of the track (.100 inch) determine the impedance of the track. We need this to be 50 ohms so the IC sees the proper impedance. (In this case we *don't* want to do any impedance transformations!)

The materials needed are somewhat special but can be found at most larger hamfests. (See the parts list.) The chip capacitors, feedthrough capacitors, and chip resistors are also available from the source shown in the parts list. The capacitor should be an MLC type (Multiple Layer Chip). The PC board is 0.032-inch thick Teflon double-sided. It isn't cheap. I paid $9 for a 4-inch by 6-inch piece. Don't substitute any other type—only Teflon will work with the dimensions given.

I made the PC board using the plastic film from Meadowlake Corporation. It is very easy to use, but you will need access to a

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Hear exciting air-craft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit.....**$29.95** Matching case set, CAR ...**$14.95**

FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz).....**$34.95**
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World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

FM-5 Micro mike kit **$19.95**

FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic unit **$5.95**
FM-2, as above but with added mike pre amp **$7.95**
FM-4, long range with very sensitive audio pickup **$14.95**
PB-1, Phone bug needs no battery, hooks to phone line **$14.95**
MC-1, Micro size sensitive mike cartridge for FM-1,2,4.....**$2.95**

SYNTHESIZED AUDIO GENERATOR

DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0. 01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

SG-550 Kit ..**$199.95** SG-550WT assembled **$269.95**

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....**$29.95**
Shortwave converter kit, SC1.....**$27.95**
Matching case set for SR1, CSR **$14.95**
Matching case set for SCI, CSC **$14.95**

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit.....**$29.95**
CAM Matching case set **$14.95**

SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stability to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit.....**$49.95**
SCN Matching case set.....**$14.95**
SCN-1WT Assembled SCN-1 and case.....**$89.95**

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experierence the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....**$59.95** CRV Matching case set.....**$14.95**
RV-1WT Assembled RV- 1 and case.....**$89.95**

TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit.....**$129.95** CURC Matching case set.....**$14.95**
URC-1WT Fully assembled URC-1 and case.....**$189.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$27.95** CSCA Matching case set.....**$14.95**
FR-1 FM receiver kit.....**$24.95** CFR Matching case for FR-1 .....**$14.95**

L-C METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit .....**$34.95** CLC case set.....**$14.95**

MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit .....**$24.95** MSC-1 DC motor kit.....**$24.95**
CSMD SMD-1 case .....**$14.95** CMSC MSC-1 case.....**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit **$34.95**
CFM Case,whip ant set.....**$14.95**

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit.....**$49.95**
CDN Matching case set.....**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case **$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$99.95**

STEREO PEAK HOLD BARGRAPH

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CIRCLE 34 ON READER SEVICE CARD

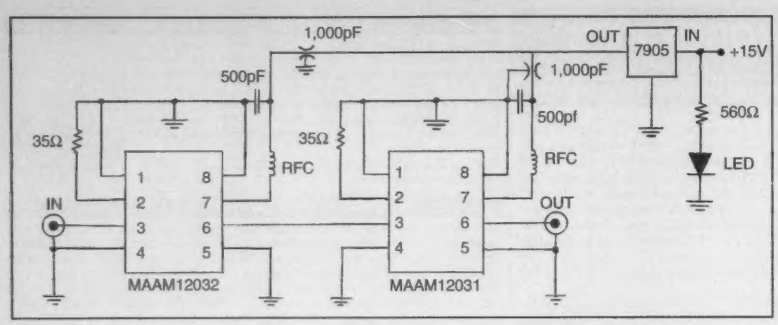

Figure 1.

Figure 2.

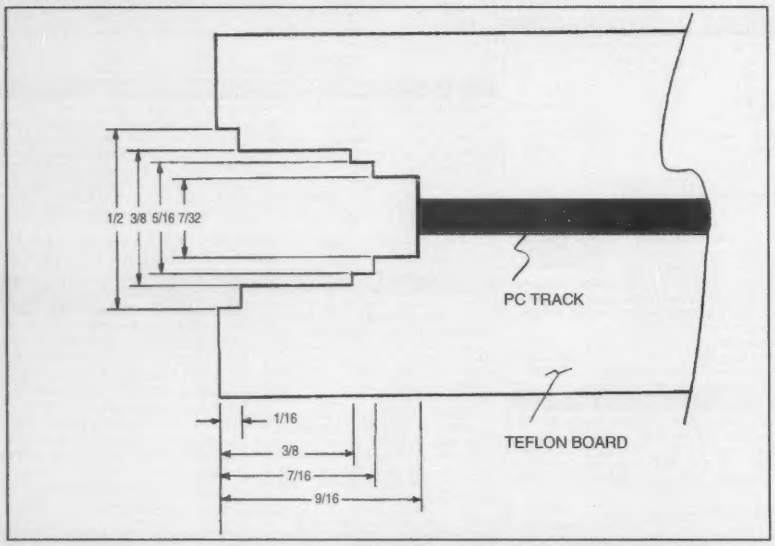

Figure 3.

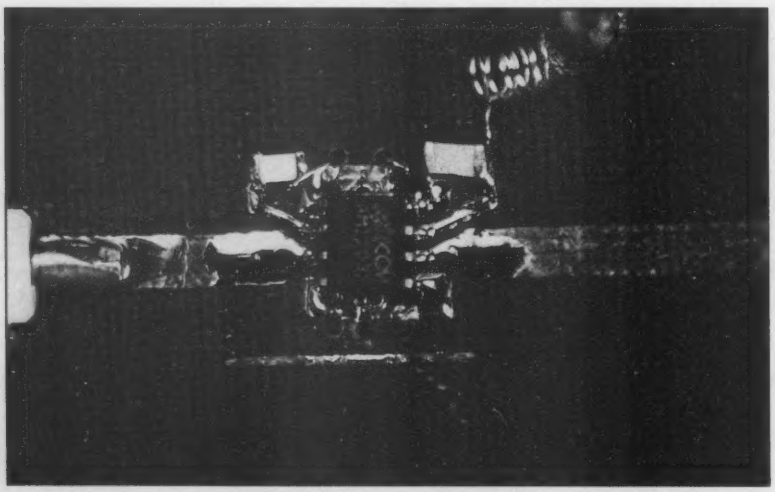

Photo B. Closeup of one stage showing all components, including "N" connector.

copying machine that has a variable reduction ratio.

The source of the ICs said they will lower their $50 minimum to $30 for these ICs. You should order two of each, just in case you damage one. If you can double-up an order with a friend, so much the better. Also, request a data sheet for each IC, or I can supply copies if you send a SASE.

The original artwork was drawn using PC Paintbrush that comes with the basic Windows software package for IBM PCs.

Construction

Start with the printed circuit board fabrication. (A printed circuit board, on Teflon, for this circuit is available for $9.50 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.) First copy/reduce the PC artwork from Figure 2. The small, thin, unattached line beside each IC pattern is used to ensure that you have used the proper reduction ratio. Continue reducing the image until this line is exactly 0.500-inch long. The remaining artwork will be the proper size. Next, the actual full-size artwork is transferred to the TEC-200 film using a copying machine. I filled the plastic sheet with as many copies as would fit on an 8.5 x 11-inch piece, so I didn't waste any of the TEC-200 film. Cut out one of the patterns and, using an iron, transfer the black pattern to a practice piece of PC board (don't use the Teflon board yet—remember how much you paid for it?). If you use the correct heat setting, time, and pressure, the traces will all have adhered to the copper with no broadening. Follow the instructions that come with the TEC-200 film. If you botched it, remove the black traces with MEK (Methyl Ethylene Ketone), cut out another pattern and try again. When you feel confident with your newfound skill, transfer a pattern to the Teflon board (first lightly clean the board with scouring powder and water). If you're happy with the quality of the pattern (no distortion or broadening of the traces) you're ready to put some resist on the ground plane side of the board. For this I used some Scotch +33 electrical tape, making sure the tape sticks to every part of the outside edge. You don't want to etch any of the bottom ground plane. Now we are ready to begin etching the board. Use a shallow plastic dish of copper etchant. The complete etching will take 15 to 20 minutes if you heat up the liquid with a spot lamp and gently tilt the dish back and forth. After etching is complete, wash the board with soap and water to remove all the etchant.

Then use a pencil to draw the pattern of the cutout for the N connectors at each end. (See Figure 3.) Use a fine square file to remove material in the cutout area. Secure the board in a vise and work slowly. Be sure to closely follow the profile of the connector and nut that you have drawn on the board.

Next, drill the four small holes near the ends of the ICs from the ground plane to the circuit side. (See Figure 4.) These are a poor man's plated through hole. Pass a small wire

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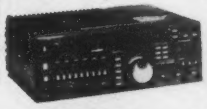

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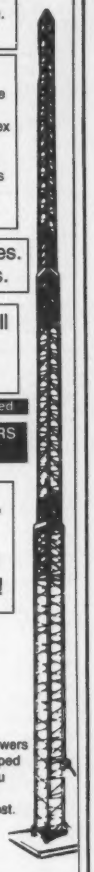

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CIRCLE 41 ON READER SERVICE CARD

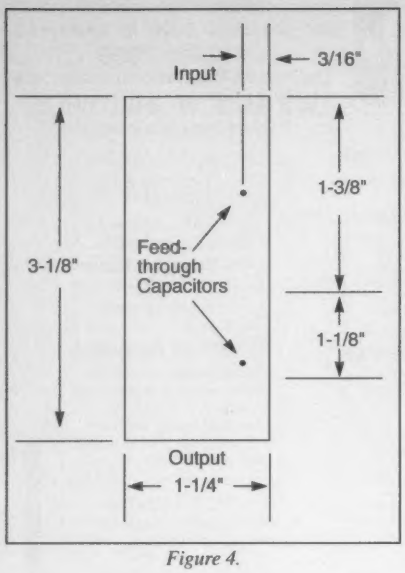

Figure 4.

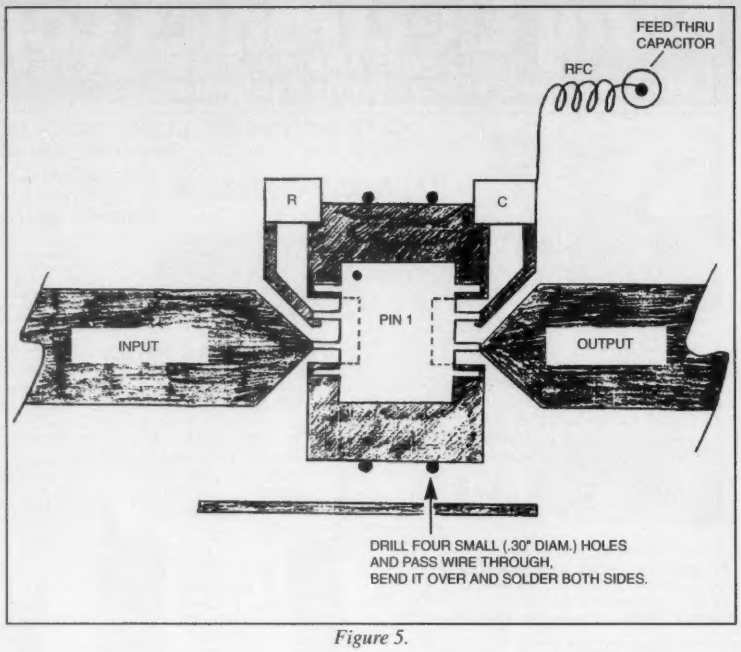

Figure 5.

through each hole, bend it toward the edge of the board on both sides, and solder. Next, drill the holes for the feedthrough capacitors. (See Figure 5.)

Make the end pieces for the N connectors out of 0.062 inch thick double-sided glass epoxy PC board. First drill the holes, then cut the end pieces to size. The hole is much easier to drill in a large piece of material. Check the sizes of the end pieces to make sure they are the same; if not, the box will be distorted and have cracks along where the panels fit together. Place the connectors in the holes and tighten the nuts. Solder the end pieces to the ground plane of the Teflon board, making sure the end pieces are square with each other and the Teflon board. (See Figure 7.) Solder the center conductor last, so you don't pull the track off the Teflon board. Next, mount and solder the resistors, capacitors and RF chokes as shown in Figure 6.

The next step is to solder the ICs in place, and TAKE . . . YOUR . . . TIME! There is a small dimple next to pin 1 on top the IC to show you how to orient the IC on your board. Use a small, fine-tipped, low-power soldering iron and small diameter solder. After soldering each pin, use a magnifying glass to check around the pins for any solder bridges. Squirt some isopropyl alcohol and brush lightly with an old toothbrush to remove any flux left on the board.

Cut both side panels and drill one small hole in one of the panels for the power lead to pass through. Next, clean all remaining panels around the edges in preparation for soldering. Solder all panels together, except the top and the side panel with the hole in it. Soldering the panels should be done with a large iron (100 watts). The side panel with the hole in it is next. Pull the wire through the hole, and then solder the panel in place. Squirt some more isopropyl alcohol inside and wash all solder joints to remove the flux. Mark the outside of the LNA with "IN" and "OUT" so you know which connector is which. Lastly, attach the top panel. Mount the 7905 voltage regulator and connect

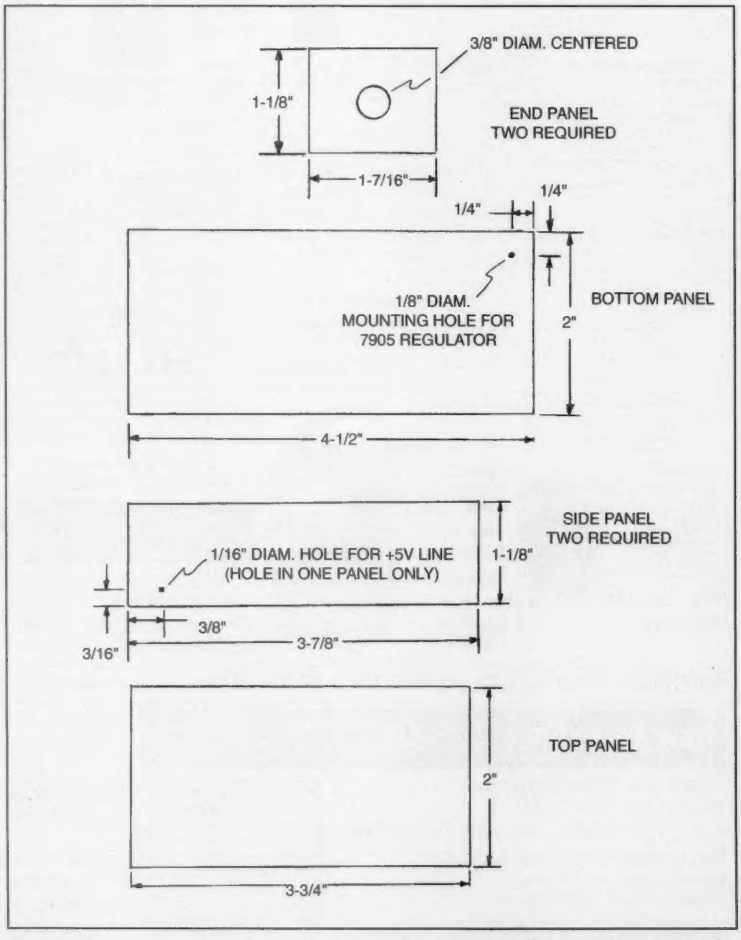

Figure 6.

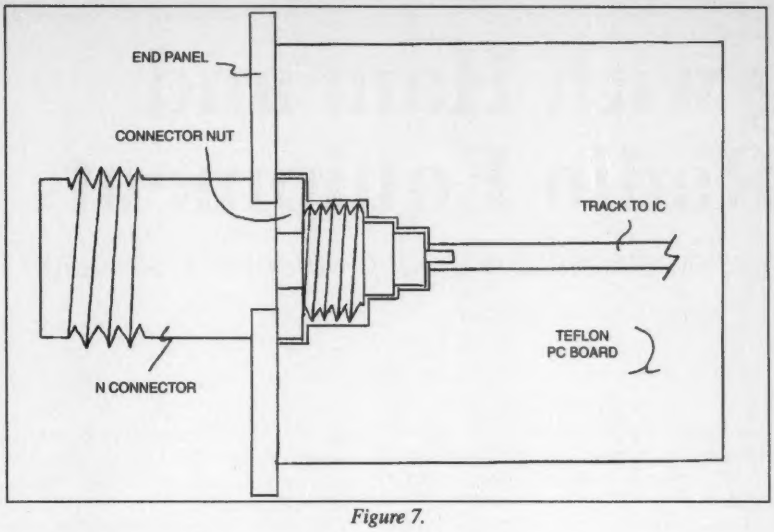

Figure 7.

the wire coming from the board to the output lead of the 7905. The center pin (ground) of the 7905 should be soldered to the side panel. Wire in the optional LED and its resistor if you want an indicator for power to the LNA.

Checkout

Apply +12 to +15 VDC to the regulator. Current draw at the input to the regulator should be 60 ma, +/-10%. If it isn't, you have some type of wiring error. Examine all the connections and check for solder bridges or other problems. Once your unit is drawing rated current, connect the output to a spectrum analyzer if one is available. The analyzer will tell you if your LNA is oscillating (bad) or not (good). If there is an oscillation, check all soldered connections for good, clean junctions. Remember: This unit has tons of gain—one loose bypass capacitor, etc., and it can oscillate. If all is OK so far and you have access to a weak signal source, apply a very weak signal (several microvolts) at or near 1691 MHz to the input, and monitor the output level. Measure the gain of the LNA; it should be near 40 dB. If you don't have access to a weak signal source, connect the LNA between your antenna and downconverter and check for a signal from the satellite. There are no adjustments to make, so if you constructed the unit properly, you should hear the characteristic 2400 Hz audio tone from GOES 8 on 1691 MHz.

You should place this LNA as close to your antenna as possible. I have mine attached directly to the feedhorn of my 5-foot home-brew dish. If the antenna is located outdoors, it will need to be weatherproofed. I have my dish located inside our garage, so I didn't have to weatherproof my LNA.

How does the LNA work? Very well! Using the LNA with my dish, a downconverter and police scanner produced a full-quieting signal from GOES 8.

I would like to thank Roger WA9OKC for his help in measuring the gain of the LNA, and Tim Ciesielski for taking the photos. 73

Parts List

1 Teflon board—0.032 inch double-clad *
1 Glass epoxy board—0.062 inch double-clad
2 Male type N Connector—3/8-inch hole mount *
2 Chip capacitor—500 pF Multiple Layer type *
2 Chip resistor—35 ohm ceramic
2 RFC (coil)—5 turns #24, 0.100 inch diameter, 0.125-inch long
2 Feedthrough capacitors—1000 pF *
1 TEC-200 printed circuit film **
1 PC etchant—Radio Shack P/N 276-1535
1 5 volt regulator IC—LM-7905 tab mount
1 560 ohm, 1/4 watt resistor—optional
1 LED—optional
2 MACOM part number MAAM12031 (one for LNA and a spare) ***
2 MACOM part number MAAM12032 (one for LNA and a spare) ***

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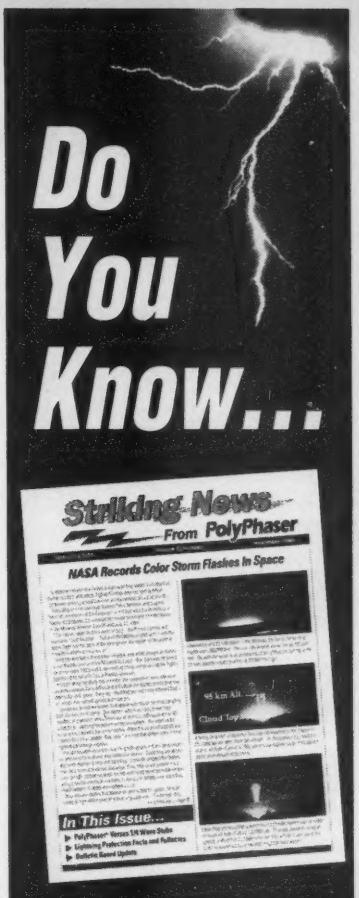

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CIRCLE 49 ON READER SERVICE CARD

Sailing with Ham and Marine Radio Equipment

Carry ham and marine systems aboard without permanent installation

by Gordon West WB6NOA

At last, summertime, and some great times out on the water aboard a boat. But you're not going to leave your ham radio behind, are you?

Sailing and boating with amateur radio is a terrific way to stay in contact with folks ashore, fellow boaters where you may be cruising, and backup communications to your regular marine radio in case of an emergency. Your communications may consist of 2 meter/440 MHz operation, and you very well might want to bring along your high frequency set, too. This article will point out how easy it is to put both of these systems aboard a boat without making a permanent installation of the entire setup. In other words, we are not talking about a permanently installed system where you are boring holes or laying hundreds of square feet of copper foil down in the bilge. Rather, you step aboard and, in a few minutes, you are on the air over VHF as well as high frequency.

"You are probably wondering if there is a way to convert a marine VHF set over to ham radio 2 meter. Nope."

VHF

A 2 meter set works great over the water to distant repeaters. The 2 meter band from 144 MHz to 148 MHz is relatively close to the marine VHF band at 156 MHz. This leads to some exciting possibilities with a sailboat that has a masthead marine VHF antenna hooked up to a 25-watt marine VHF set down at the navigation station. The marine VHF antenna works quite nicely at 146 MHz with only a slight rise in SWR. The tremendous boost in range because of the antenna height will be well worth the slight mismatch when transmitting into the antenna 10 MHz away from its naturally resonant frequency.

Don't disturb the installed marine VHF setup until after you get to where you're going. You might be the only one hearing a Mayday call on marine VHF Channel 16. If you want to play 2 meter ham radio on the way over to that distant anchorage or island, use the antenna that comes with your set, and leave the marine VHF system alone. Wait until you get to that distant cove and drop the anchor before you start playing ham radio with a marine VHF installation.

Many mariners tie the marine VHF antenna into their 2 meter hand-held transceivers. To do this, you will need an adapter that converts the marine PL-259 antenna plug over to a BNC connector. These adapters are available at all Radio Shack stores, and consist of a single piece with SO-239 threads that connects to a BNC that goes to your 2 meter hand-held antenna jack. Remove your rubber duckie, slip on the adapter, and then unscrew the coax cable that goes to the marine VHF transceiver onboard.

WARNING: *Use the marine VHF antenna only when the marine VHF transceiver is specifically turned off and not being used for marine radio calls and distress channel monitoring!*

If the cable coming down from the masthead antenna is rigid RG-8U, be careful not to flex the adapter on your hand-held 2 meter transceiver. Too much flexing on your hand-held antenna jack from heavy coax cable could ultimately break loose the hard-wire connection from the tip of the BNC jack to the PA transistor point on the internal circuit board. If that connection gets broken, it's a delicate fix! Be gentle with your hand-held antenna connection with coax going to it.

When you are hooked up to your sailboat marine VHF antenna, or to a 6-foot, or 9-foot, or 23-foot power boat white Fiberglas marine VHF antenna, 2 meter reception will boom in. Enjoy! Your little handheld on a 9-dB-gain power boat VHF antenna will sound like a 40-watt output (8X) improvement as compared to a little hand-held telescopic whip. The big marine antenna to a rubber duckie is like night and day—even though the marine antenna is not absolutely resonant down at 146 MHz, you will still have one heck of a signal on both transmit and receive from the multiple elements inside the Fiberglas whip. And to a masthead sailboat antenna, the height of that half-wave antenna will give you terrific results on 2 meters.

CAUTION: *Don't transmit on the 440*

Photo A. The Icom IC-M710 is in the marine SSB mode, set to distress frequency 2182 kHz.

Photo B. Now the IC-M7100 is a ham set, tuned to a 40 meter net on lower sideband.

MHz 70 cm band! Marine VHF antennas don't work on the amateur radio 440 MHz band, and attempting to try to get them to work could lead to an almost direct short on your power output jack. Many marine VHF antennas are DC, shunt-fed, half-wave in design, and except at a broad resonant point near 140 MHz to 160 MHz, the antenna looks like a DC short to other frequencies. Take my word for it, there is no way to get a marine VHF antenna to transmit on the 222 MHz or the 440 MHz bands,

If this is your own boat, and you are an active dual-bander on 2 meters and 440, you may ultimately wish to replace your marine VHF antenna with a ham radio 144/440 MHz dual-band antenna, and enjoy great results on both ham and marine VHF.

Modifying Sets

You are probably wondering if there is a way to convert a marine VHF set over to ham radio 2 meter. Nope. Marine VHF transceivers are preset for 25-kHz steps that correspond with the 55 marine transmit channels, and there is no way to take this type of PLL 25-kHz logic and swing it over to the amateur radio 2 meter band. Marine VHF also has a tight front end, and reception 10 MHz off of 156 MHz marine reception would be next to zip. There is absolutely no way to convert a marine 25-watt VHF radio or a marine VHF handheld over to 2 meter capabilities.

Yes, there is a way of modifying most 2 meter handhelds and some 2 meter VHF sets for emergency transmit on marine VHF. But you may not legally transmit on marine VHF with a 2 meter handheld, because your 2 meter handheld does not possess the necessary FCC Part 80 type-acceptance spelled out in Marine Rule 80.43: ". . . Transmitters . . . must be type-accepted for a particular use by the Commission based on technical requirements . . ." However, in an emergency, marine Rule 80.311 allows any type of transceiver to be used in a distress: ". . .Station in distress may use any means at its disposal to attract attention . . ." This means a modified 2 meter ham radio transceiver is perfectly allowed to come up on marine VHF Channel 16, 156.800 simplex, to holler "Mayday!" in a life-and-death situation.

By the way, using your ham radio set aboard a cruise ship requires permission of the master of the ship before transmitting. Same thing for private vessels—be sure to get the skipper's permission before you start transmitting over the airwaves.

High Frequency SSB

The high frequency marine radio system offers ship-to-ship and ship-to-shore frequencies for the non-ham mariner on the following bands:

2 MHz	12 MHz
4 MHz	16 MHz
6 MHz	22 MHz
8 MHz	26 MHz

"The ship station license does not require a test, other than the mental anguish in poring over FCC Form 506 and getting down all the information the FCC requires."

Mariners cruising beyond normal VHF marine radio line-of-sight range to the Coast Guard and other stations are encouraged to equip themselves with marine SSB. FCC Form 506 allows ship station call letters to cover not only the marine VHF onboard, but also long-range marine SSB equipment, in addition to radar and emergency-position-indicating radio beacons. The ship station license does not require a test, other than the mental anguish in poring over FCC Form 506 and getting down all the information the FCC requires. For marine single sideband, you must also hold a restricted operator's permit, valid for life. This is the brown card that you might have been carrying in your wallet from the old days of operating business radio, taxi radio, police radio, or aircraft and marine radio. The restricted operator's permit does not expire, and you obtain it by filling out FCC Form 753. *To receive a free copy of FCC Form 506 and 753, send a large self-addressed envelope with six first-class stamps on the inside to Gordon West Radio School, FCC Forms, 2414 College Drive, Costa Mesa, CA 92626.*

Marine single sideband is channelized, by international agreement, with specific channels for duplex operation to marine telephone stations ashore, simplex channels for ship-to-ship, and duplex channels for ship-to-Coast Guard. (For a list of marine ITU simplex and duplex SSB high frequency channels, four first-class stamps and a self-addressed envelope to Gordo will get you the latest list.)

Marine SSB emissions are single sideband, identical to ham radio HF emissions. However, all marine frequencies are upper sideband, whereas high frequency ham is either upper sideband or lower sideband.

Marine SSB transceivers must be FCC Part 80 type-accepted. The main reason for type-acceptance of marine SSB is to insure spectral purity, with in-hertz frequency stability, minimum harmonics, and user lockouts to prevent a marine SSB transceiver being dialed into unauthorized frequencies.

Double-use Sets?

Interestingly, that last item, "user lockout," has taken a new meaning when manufacturers developed their latest breed of marine SSB transceivers. SGC, Inc. (Bellevue, WA), indicated that the marine SSB Model SGC-2000 is rated for both Part 80 marine radio use and ham radio use. And since amateur transceivers don't require type-acceptance, using a marine SSB with an agile synthesizer on amateur radio high frequency ham bands is indeed technically feasible, with a signal that is just as clean as any modern ham radio set. Model SGC-2000 requires no additional modification or "diodectomies" to work straight out of the box on ham HF SSB. Same thing with the Icom M-700 and Icom's latest dual-purpose marine/ham transceiver, the sleek IC-M710.

Almost all other marine SSB transceivers are easily dialed into the amateur HF bands with some simple keystrokes to unlock the transceiver, or the snip of a diode here and

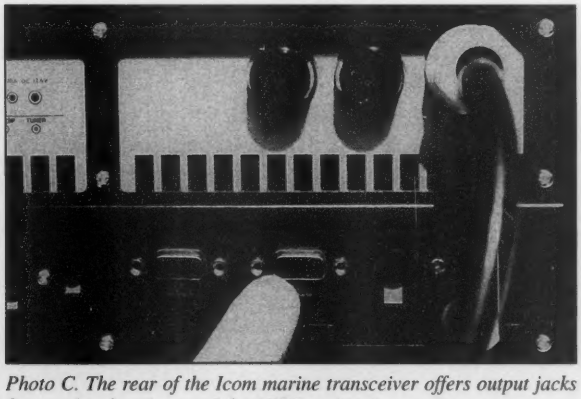

Photo C. The rear of the Icom marine transceiver offers output jacks for weather fax, data, and the APRS positioning service.

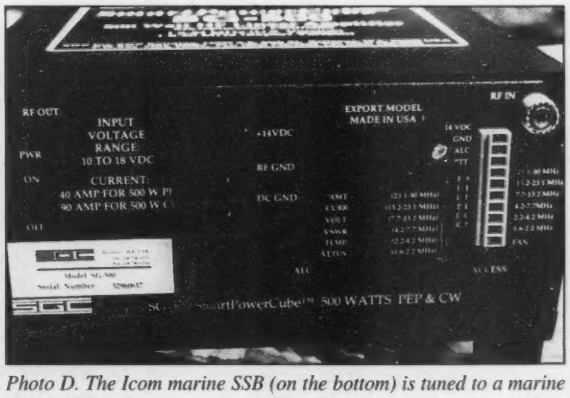

Photo D. The Icom marine SSB (on the bottom) is tuned to a marine duplex channel.

there. But once you cut a diode, you have now nullified the type-acceptance of that marine transceiver for Part 80 marine use.

If you have modified that marine transceiver permanently over to ham radio use, no problem. Keep in mind that FCC Part 80 rule that lets you holler "Help!" into any type of set in an emergency.

But what about Model SGC-2000 and the new Icom IC-M710, where no modification is necessary to access the ham bands? Is this legal? Opinions vary within the Federal Communications Commission.

George Dillon of the FCC Marine & Aviation Branch points out amateur radio Rule 97.11 for radio equipment aboard ships: ". . . The station must be separate from and independent of all other radio apparatus installed on the ship . . . except a common antenna may be shared with a voluntary ship radio installation . . ." Dillon points out this rule is an old one aimed at "sparky," the commercial radio operator, to prevent his playing ham radio down on 160 meters when he should have been listening to 500 kHz CW traffic.

FCC's Jerry Freeman W4JJ, an avid ham and boater, raises the question about a voluntary marine SSB installation and how that station is to be used by the licensed amateur operator. Could the ham go down to the boat on a Monday and consider that marine SSB transceiver as a marine radio for making a ship-to-shore phone call, and then go down to the boat on Tuesday and put on the ham hat and consider this apparatus as perfectly legal on the ham bands? After all, hams can use *any* type of radio equipment on ham bands as long as it meets with good engineering practice and clean spectral output. Jerry Freeman would point out that a separate ham set and a separate marine transceiver would definitely meet the letter of the law, but how a licensed ham would view an SSB transceiver would be an interesting question to ponder. And since voluntarily equipped vessels are not required by law to have a specific listening watch on marine SSB, or required by law to have a marine SSB onboard, who's to say that the new SGC or Icom marine transceiver is really an SSB marine radio rather than an agile ham rig with Part 80 emergency capabilities?

How about the popular practice of modifying a ham set for marine ship-to-ship and ship-to-shore communications? *Absolutely illegal,* comment both Freeman and Dillon of the FCC. Ham sets are not Part 80 type-accepted for marine radio use and, except in an emergency, cannot be used on marine radio frequencies.

Emergency Use

Any rule that prohibits a ham from making the necessary modification to the HF ham set for emergency marine transmit? None on the books—and many mariners will dive into their ham radio HF transceivers, perform the modification, store simplex ship-to-ship and duplex ship-to-shore channels, and have them available for a true emergency call.

Wouldn't you rather communicate directly with the Coast Guard when you're pulling people out of the water from a nearby emergency rescue than calling Mayday on 14.313 MHz and ending up in the middle of a jam session? I certainly would feel more at ease out on the high seas knowing that the United States Coast Guard Rescue Coordination Center is just a call away over marine SSB channels than hollering for help and ending up with someone telling me to QSY because they're working rare DX down the bottom of this band.

What I recommend is to analyze how you plan to use your HF SSB capabilities out on the water. If you're going to be using mostly marine channels and marine ship-to-shore frequencies, go with the marine SSB transceiver, but choose the SGC or Icom sets that require no modification for ham radio use when you are no longer using this same radio as a marine SSB set.

"Wouldn't you rather communicate directly with the Coast Guard when you're pulling people out of the water from a nearby emergency rescue than calling Mayday on 14.313 MHz and ending up in the middle of a jam session?"

However, if you are an avid ham, and only need the *backup* of marine SSB distress channels in an emergency, then run the ham set aboard, but have it ready for emergency transmit capabilities with marine channels stored in ham memory slots. The best ham sets for this purpose would be any Kenwood, Yaesu, Icom, and Alinco HF transceivers offering 100 simplex or duplex memory slots. The modified ham set for emergency capabilities should also be netted with WWV using upper sideband for spot-on center channel, because most ham sets are set a couple of hundred hertz low (hertz, folks, not kilohertz) to compensate for the ultimate slight drift of the PLL reference crystal. On ham frequencies, 200 hertz is nothing—but it will quickly earn an FCC pink slip on marine band. And using a ham radio for routine marine channel communications will earn a major FCC pink slip if you should get caught.

Having a marine license aboard, a personal marine restricted operator's permit, and a General Class ham license, and then using a Icom or SGC marine set on ham radio—I couldn't find an FCC engineer who has ever written anyone up for a legitimate operation of this type.

The Antenna Setup

The marine and ham SSB transceiver usually feeds to a fully automatic microprocessor antenna coupler. On sailboats, the coupler goes back aft in the lazarette and feeds a single-wire output (called GTO-15 high voltage wire) to an insulated backstay or to a 23-foot nonresonant aerial. On power boats, the microprocessor automatic antenna coupler feeds a 23-foot white Fiberglas aerial, and both systems use copper foil down to bonded underwater through-hulls for a good ground plane "push off." Copper foil is used to minimize the inductive reactance found in round ground wires. Just a couple of interconnections to the water is all that's necessary for an adequate ground plane using the modern microprocessor-based tuner. For temporary installations, many mariners chose the Outbacker "OBM" ham/marine resonant whip with specific band taps for each ham band and each marine band. Simply plug the "fly lead" into the appropriate band—say 20 meters for ham, or 8 MHz for marine—and the whip operates as a 1/4-wavelength, pretuned, helical-wound resonator with a tunable tip to adjust SWR to a minimum.

The Outbacker "OBM" for the ham-only/marine-only whip *must* be mounted over a horizontal stainless steel rail in order to work. The horizontal rail acts as the ground plane for the 1/4-wavelength whip. No metal rail, no worky. The whip cannot work off of Fiberglas, nor will it work mounted to a teak or composite deck. The whip does not mount at the top of the sailboat mast, nor does it mount with a ball mount on the side of the hull. It must be mounted with its included stainless steel bracket directly over a horizontal metal rail with at least three feet of rail on one side or both sides of the whip. The tail should also be counterpoised to a sea water or fresh water ground via metal through-hulls in the boat.

Performance on the Outbacker? Eighty percent of what you would get with an automatic tuner into a 40-foot backstay. (A mounting installation booklet and technical reference sheet on the marine Outbacker antenna are available free with a self-addressed envelope and 6 stamps to Outbacker, 330 Cedar Glen Circle, Chattanooga, Tennessee 37412; Att: Don Arnold WD4FSY.)

Fun and Safety

Maritime mobile can be a lot more fun this summer when you bring your ham radio equipment onboard. You don't need to bore holes, nor lay hundreds of feet of copper foil to achieve long-range results. And in an emergency, you could use your ham set on marine frequencies, too.

And while you are out cruising, be sure to switch your installation back over to your marine setup, and guard the distress channels for others around you who may need a radio lifeline for help. 73

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First Look at the Radio Shack HTX-212, 2 Meter Mobile Transceiver

It looks like any other two meter mobile, but this product is unique.

Over the past couple of years Radio Shack has established itself as a supplier of moderately priced communication radios. In the handheld department, the HTX-202 and HTX-404 handhelds have been a popular selling item for the boys from Ft. Worth. Sooner or later, you almost knew Radio Shack would offer a legitimate two meter mobile radio. Since I own an HTX-202, I was curious as to what I might find with this new mobile and how it compared with other 2 meter mobile radios I own.

The HTX-212 looks like any other two meter mobile. The multipurpose buttons, front panel display, and a very small case make the HTX-212 a nice-appearing radio, resembling most 2 meter rigs on the market today. In fact, there's a strong resemblance to the Kenwood line of two meter transceivers, yet after a lengthy discussion with Radio Shack personnel, I am confident that the HTX-212 is uniquely a Radio Shack product. In addition to the transceiver itself, the manual, a single-fused power cable, the DTMF microphone, and a mobile mounting bracket are neatly packaged within the small shipping box. The mobile bracket can be mounted either on the top or the bottom of the radio. Large thumb screws with rubber washers and a microphone attach-clip complete the mobile attachment.

Features

The HTX-212 offers selectable power output (10 or 45 W), built-in DTMF encoder and decoder, dual VFOs, 31 memories, multiple scanning schemes, and extended receive frequencies. Couple these and other features with probably the best sounding transmit audio of any transceiver on the market today and you have the Radio Shack HTX-212.

The receiver is a dual conversion type, with a first IF of 21.4 MHz and a second IF of 455 kHz. With 0.25-microvolt sensitivity, not too many calls will go unheard.

The front panel layout is fairly standard; however, some features requiring the use of multifunction buttons can be confusing, if not dangerous. This holds true especially if you try to access them while driving. Several buttons are not intuitive, so keep the plastic cue card close by. The manual does not address all the functional indicators in the display, but, fortunately, most operators can figure out most indicators without any explanation. When powering up, all annunciators in the display light up and a three-tone announcement signifies "all's well."

Panel brightness is adjustable as bright/dim. However, during daylight you'll find no difference, and in the dark the difference between bright and dim is functionally insignificant.

CTCSS encoding and decoding are both supplied as standard features. Unlike some radios which limit the number of stored digits to 6 or so, the HTX-212 allows up to 16 digits per CTCSS memory, enabling the operator to store access codes and commonly called phone numbers, a safety feature while driving.

The HTX-212 did not get hot during long periods of operation on high power, due to the extra large finned heat sink. Nor did the radio get hot or fail when it was run at full power without an antenna. The HTX-212 SWR protection circuits are designed to protect it while transmitting at full power without an antenna load, or with a dead short at the antenna connector.

There are two methods of selective tone paging, subaudible and standard DTMF tones. When chosen, either method will turn on the speaker and sound a three-tone alert. An "auto-reply" confirmation code can be automatically transmitted to the sending station, acknowledging receipt of the call. For those operators who need selective calling, the HTX-212 offers *group calling.* A large group (e.g., local RACES or search and rescue groups) can be individually assigned a special identification number. The whole group can be simultaneously sent a page, or any portion of the group can be earmarked for calling.

The HTX-212 has the scanning functions common to all two meter rigs on the market: band and memory scanning, selectable boundaries, lockouts of unwanted channels, call and priority channels, etc. All scanning commands must be initiated from the front panel, as Radio Shack does not offer scanning from the up-down buttons on the microphone. During my tests of the HTX-212, I found that reaching for the small memory scan button or accessing the timed two-button sequence for VFO scanning can be difficult, if not unsafe.

Manual

The 40-page manual is written to satisfy all classes of users. The novice will not be intimated by technical language while experienced users should not be insulted, either. Several diagrams illustrate the hows and whys of assembly and mobile mounting, very helpful if you've never had the opportunity to install a mobile rig. As with other Radio Shack equipment, I'm sure they will offer one of their excellent service manuals.

An X-ray view of the mike plug identifies all eight wires for use in connecting a packet TNC system. No mention is made of the type of plug or where you can get one, but Radio Shack's corporate offices assure me that the plug is used in computer networking and is carried as their part number 279-440.

Separate from the manual, a plastic cue card lists the more common and popular features. The card is well done and designed to fit in your car's sun visor. One of my other two meter mobile rigs came with a fold-up wallet cue card. After several months pressed in my wallet, the card was not usable.

Performance

Attempts to introduce cross modulation and intermodulation were fruitless. Although my testing was in a non-lab environment, I spent two weeks on the road through New York, Vermont, and Connecticut, during which I subjected the transceiver to actual everyday use, including leaving the rig in a rental car overnight in minus-13-degree cold, installing the rig in three different vehicles, and getting power

from both direct battery connect and cigarette lighter plugs. Results: no problems! I purposely pulled up behind city vehicles that were transmitting, drove through Hartford's infamous "intermod alley" and ran another two meter rig in the car. Never did I experience any unwanted interference. This exceptional selectivity feature of the HTX-212 is the result of the Radio Shack engineers' use of a "Tracking Bandpass Filter." TBFs are expensive and seldom seen in amateur radio equipment. The front end of the HTX-212 is as tight or tighter than the HTX-202 handheld. To the country boy, front end selectivity may not be very important, but anyone near the big city needs all the help they can get.

One of the first things noticed when I put the rig on the air was its excellent transmit and receive audio. At one time or another, someone will comment about the excellent quality of the transmit audio. While sitting in the mobile with the windows down, I've had no problem understanding stations through the built-in speaker.

Criticisms

Owning the HTX-212 has been a love-hate relationship. The good features I covered above.

What's missing? The ability to store out-of-band frequencies in memory. Since you cannot store the local weather frequencies or public safety stations, you have to ask why the expanded receive even exists. However, either one of the two VFOs can be used as scratch pad memory allowing storage of any two out-of-band frequencies. Of lesser import is the unlit keypad on the microphone. I say lesser only because backlit microphones are seldom visually clear enough to see in the dark, anyway. However, I know of no other major contender in the two meter mobile arena that does not have a backlit DTMF mike.

Although this is a mobile transceiver, I feel that Radio Shack engineers forgot the ergonomics of mobile operation. Using the DTMF memories while mobile can be a bit dangerous. As many as six key strokes must be made to set the correct DTMF channel, access the frequencies, and reset/return to normal operation. I programmed the access (UP) code for the autopatch of a local repeater in DTMF memory 1, my home phone number in memory 2, and the disconnect code in memory 3. In my neck of the woods, autopatch access codes are five characters or more. The multiple key strokes required on the HTX-212 should only be done while the automobile is at rest. Better yet, manually keying in an autopatch may actually be easier and faster!

The only performance flaw I found is in the squelch. Once set, the set point appeared to drift. Motorboating begins with the squelch eventually opening completely. I also observed that the squelch set point appears almost at the end of the squelch control travel, approximately 30 degrees from the end. Attempts to isolate the cause to something in the car was futile, indicating randomness. I noted this problem in all three rental cars and also the family car, usually after extended operation.

Value

When comparing suggested retail prices, the HTX-212 is positioned as much as 25% less than the suggested list price of the competition. However, street prices of other transceivers, coupled with sales promotions, (often called promos) could eliminate any pricing advantage. Regardless, one area that competition won't be able to approach is the extended warranty offered on the HTX-212. For less than $8.00 a year, five years of warranty can be purchased from Radio Shack dealers.

Wrap-up

The HTX-212 is a small two meter mobile transceiver that, like its sibling the HTX-202, may become the number one selling two meter mono-bander. The value of this rig does not lie in its features or any superficial gimmicks but in in its robust design and high quality of manufacture. Setting the inconveniences aside, the HTX-212 is a solid rig, with performance equal to or better than what is available in the market today. 73

General

Frequency range:	144.60—148.00 (Transmit) 136.00—174.00 (Receive)
Steps:	5/10/12.5/20/25/50/100 kHz
Memory channels:	1 calling frequency memory 30 standard frequency memories
Mode:	FM (F3)
Power Supply:	13.8 VDC ± 15%
Output/current drain:	Transmit—high (45 W) = 9A low (10 W) = 7 A Rec-stdby—0.1 mA
Dimensions:	42 x 142 x 160 mm

Receiver

Type:	Dual conversion superheterodyne
Interm. Frequency:	1st: 21.4 MHz 2nd: 455 kHz
Sensitivity:	0.25 µV for 12 dB SINAD
Spurious response atten. and adjacent channel rej.:	Both better than 60 db
Audio output:	2.0 watts w/2% distortion max.
Hum/noise:	Greater than 40 db

Transmitter

RF Output:	45 W (high)/10 W (low)
Spurious emission :	Better than 60 dB
Max. deviation:	5 kHz

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Pasokon TV Slow-Scan TV Interface

SSTV for everyone!

Amateur slow-scan TV has been around for many, many years. The first experimenters used long-persistence phosphor displays "liberated" from old radar systems, and the quality was crude, to say the least. Still, it was a tremendous achievement to transmit pictures over our 3-kHz voice channels, and the SSTV art has slowly evolved ever since. The next wave used dedicated scan converters, which were digital memory boxes that could convert the normal TV scan rate down to something slow enough for narrowband transmission. The converters worked well, but they were quite expensive, and most were limited in their image processing capabilities beyond the basic functions of transmitting and receiving.

There are still plenty of the latter-generation dedicated scan converters on the air, and a few are still being made. These days, though, the trend is toward a more powerful, cheaper SSTV realization using that ubiquitous digital box we all love so much: the personal computer.

Wanna see what's being sent on 14.230 and 14.233? Wanna send some pictures of your own? All you need is an IBM-compatible computer and the new Pasokon TV system, which includes an interface board and the required software. I just recently got mine, and I'm having a great time with it.

Photo A. Screen shot of Pasokon's Mac/Windows-like interface.

What You Need

Although the system can be run on a 286, you're much better off with a 386 or higher processor. I tried using it on my old 286, and it worked on most modes, but came up with "machine too slow" when I tried to receive some Robot 12-second pictures, which come in pretty fast and actually demand more of the computer than the newer, slower modes.

You need a standard ISA bus; the thing won't work with a microchannel bus of the PS/2 type. The more memory you have, the better, but you can run the system on anything, even 640K! Extra memory, however, lets you store multiple pictures in RAM, which is extremely handy, for reasons I'll get into shortly. A mouse is very useful with the Pasokon system, but you don't need one. I don't have one and I'm able to use all the functions without it.

The quality of displayed pictures depends a great deal on your VGA card. The system works best on a 1-meg card with 32K color capability and VESA 1.2 conformance. I tried it with such a card, and the pictures were pretty stunning. You can, however, use it with a less capable card. My 1-meg card blew a RAM chip (through no fault of the Pasokon) and I switched back to my old 512K, 256-color card. At first, it looked terrible. After reading the manual, though, I ran the included universal VGA driver, and it allowed the Pasokon to use my card in a better graphics mode. The result was that pictures looked almost as good as with the 1-meg card, though not quite. No matter which card you use, the system still receives and saves pictures in the highest quality; if you later upgrade your card, you can see previously saved pictures in higher quality!

"The system works best on a 1-meg card with 32K color capability and VESA 1.2 conformance. I tried it with such a card, and the pictures were pretty stunning."

What You Get

The Pasokon TV system consists of an interface board, a 3.5" disk and a user manual. The interface board is basically a modem

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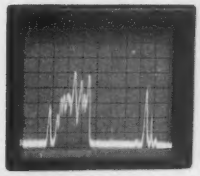

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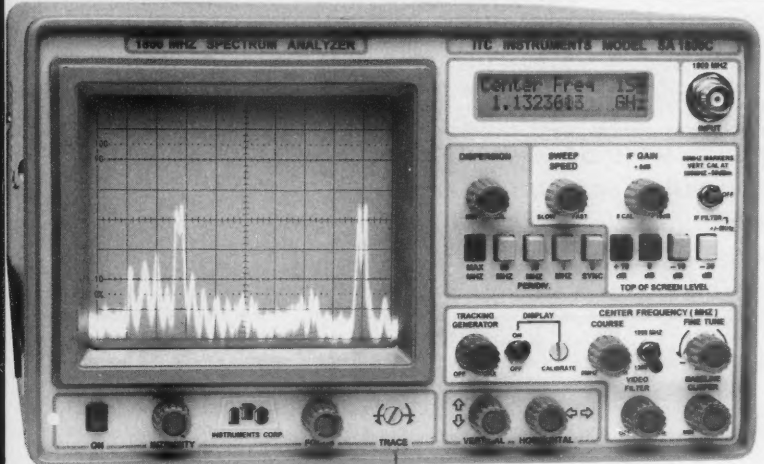

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Photo B. With the press of a key, the interface vanishes, and the image grows to full-screen (320 x 240) size.

and a timing circuit which helps the computer decode the SSTV information. The computer itself does most of the work, which is as it should be. The system supports just about every SSTV mode ever created, including the AVT (Amiga Video Terminal) standard. Unlike other modes, AVT does not use horizontal sync pulses, requiring very precise timing on both the transmitting and receiving ends in order to avoid slanted or distorted pictures. There are some advantages to that approach, the biggest one being that fading, noise, or QRM cannot mess up the sync timing, because there isn't any sync in the first place! Pasokon TV supports the AVT mode the right way, using its own onboard, crystal-controlled timing oscillator, rather than trying to rely on the computer's timing, which can vary from machine to machine. To make sure the timing comes out exactly right, there's even a trimcap, accessible from the outside, so you can set it perfectly. You can do this several ways: by watching pictures as they come in, using an external receiver to calibrate the oscillator, or connecting a frequency counter. If you have one, that's the quickest, best method. The board comes pre-calibrated, so you may not have to do it at all.

It is important to note that, like all currently available computer-based SSTV systems, the Pasokon does not include a video digitizer to get your own pictures into the computer for sending. Of course, you can still send computer-generated images and pictures you've received from other stations, but, if you want to send live "snaps" of yourself, your shack, your dog, or that latest homebrew gadget on your workbench, you'll have to find some way to input the pictures. Digitizers can be had for about $300, or perhaps you can use a friend's unit to get a bunch of pictures ready for transmission. Once you have them on a disk, you can put them into your computer and be ready to go.

Getting It Running

Basically, you just plug the board in, install the software and wire up the cables. Although common wiring schemes are shown in the manual, no pre-wired cables are available; there are just too many kinds of rigs out there to make that possible. Cleverly, the Pasokon board includes a relay for audio routing, so that you can keep your mike connected. Or, if you're using your radio's accessory connector, you can keep your TNC, RTTY unit or other outboard gadget hooked up. When you operate SSTV, the Pasokon takes over and routes the audio to itself. When you go back to other modes, the relay switches out and the Pasokon effectively disappears. It's all pretty convenient. You will, however, have to make the cable, using the included interface connector and your own audio plugs, which you provide. But heck, we're hams! If we can't even wire up an audio connector, what are we doing in this hobby? For most of us, it should be no problem at all. I had mine up and running in about fifteen minutes, and it worked the first time.

If you have a standard PC, with standard addresses and interrupts, the Pasokon board should be all ready to go. Just plug it in and you're done. If, however, your machine has some conflict, perhaps due to other peripherals sharing the same address space or something, you'd better know something about PCs and their architecture. You can set the Pasokon for other addresses and interrupts, but the manual assumes you know what you're doing; it's not written for beginners.

By the way, you can't run this thing under Windows, Dosshell, or any other menu shell program, because the decoding of SSTV signals requires very precise timing with which the menu programs can interfere. So, you'll have to quit out of Windows and run it under DOS. Luckily, it's no big deal to do that.

How It Works

After the software loads, you're presented with a Mac/Windows-like screen, with various buttons for transmission, reception and mode. At the top are pull-down menus for numerous functions, including saving and loading pictures, selecting from the included noise-reduction and enhancement routines, and even running other programs (such as for a digitizer) without quitting the Pasokon environment. You can use the menus with a mouse or by pressing the ALT key.

Receiving Pictures

All you have to do is fire up your computer, set your rig on an SSTV frequency such as 14.230, press the on-screen "receive" button and wait. The Pasokon decodes the VIS (vertical interval signal) codes which tell SSTV systems in what mode the picture is sent. It's really nifty to watch it switch to, say, Martin 1 when the picture starts. If, though, you tune in after the picture begins, you can still select the mode manually, as long as you know what it is. That might also be necessary if noise or QRM obscures the VIS code. Most of the time, though, the automatic feature takes care of it quite well.

"All you have to do is fire up your computer, set your rig on an SSTV frequency such as 14.230, press the on-screen 'receive' button and wait."

If you're using an analog rig, or the sending operator is a bit off frequency, you may need to fine tune your receiver. The Pasokon includes a real-time, on-screen tuning indicator that is actually an audio spectrum analyzer! It shows you the incoming audio on a little, vertical graph, with a red box at the bottom for the sync. To tune, you just center a line within the box, and you're done. It isn't very critical, though, because the software will lock to signals as much as 100 Hz off frequency. The line also serves another function: it indicates the software's degree of certainty that it is, indeed, receiving sync pulses. As the sync is received, the line gets longer. If fading or noise starts to obscure the sync, the line shrinks and eventually disappears.

As a picture comes in, it's displayed in real-time in a generous window next to the tuning indicator. After the image is complete, you can press a button and the user interface will go away and be replaced by a full-

screen image of the received picture in all its 320-pixel by 240-line glory. It looks great!

Well, usually. If QRM or other noise has damaged the picture, you may be able to clean it up a bit using some of the included image enhancement features, such as low-pass filtering or two kinds of noise reduction. Depending on the original state of the image, these features can really help, although they sometimes blur the picture more than you might want. That's no fault of the Pasokon software, though; it's an unavoidable price of some of these kinds of image manipulation.

If you have extra memory, here's where it comes in handy. Instead of saving the picture immediately, which might cause you to miss the next one coming in, you can just leave it in memory. A small box at the bottom of the screen will display it in postage-stamp size. Depending on how much extra memory you have, you can get up to ten simultaneous pictures across the bottom of the screen. My 2-meg machine gives me four of them. I just save 'em up until there's a lull on the frequency, and then I store them to disk at my convenience.

Two extra-cool features in the Pasokon are its sync squelch and auto-save, which let you walk away and snag pictures automatically. The sync squelch makes sure voices or noise don't get misinterpreted as picture data, and the auto-save dumps received pictures to disk, using a numbered naming scheme. So, you can start it all up, go away for awhile, and come back to a whole bunch of images already stored on your hard drive.

"The Pasokon is the most fun I've had on amateur radio in a long time. I highly recommend it."

Transmitting Pictures

As I mentioned before, there's no included digitizer. There is, however, a provision to take 3-D pictures! The procedure requires you to take two snaps with your digitizer, one for the left and one for the right view. The software then alters the colors of the two views and combines them so that the resulting picture looks 3-D when viewed with red/blue glasses, which are included. And yes, you can send that image and it will still look 3-D at the other end, as long as the receiving operator also has the glasses.

To send a picture, you just get it into memory, either by digitizing some video, loading a stored image from disk or simply receiving a picture off the air, and then select the desired transmission mode and press Xmit. Away it goes! You don't have to convert the image in any way to use it in various modes. Even if you received it in Scottie 1, you can send it in AVT if you feel like it.

There's an externally accessible trimpot on the board which lets you adjust the audio output level, so you can set it up for the desired output power level from your radio. Many radios can't send SSTV or other full-duty-cycle modes at full power, requiring you to reduce it to half or less. I set mine up so it would put out 50 watts with the mike level control set to its normal voice position.

What I Liked

The Pasokon does exactly what it's supposed to, and it does it well. It supports various graphics standards, including GIF, TGA and PCX, so you can easily upload your received pictures onto online computer networks. And, converting a TGA file into GIF is as simple as loading it and resaving it in the new format. The software is easy to use, and the hardware installation is fairly hassle-free, as long as your computer doesn't have any special requirements. The cost of the system is very reasonable for what it does.

What I Didn't Like

There isn't much to complain about on this thing, but there are a few minor points. When you save a picture, the screen doesn't show its filename above the image until you reload it. That makes it hard to know which received pictures you've already saved. It would be better if the filename appeared as soon as the save was complete.

Although the image enhancement features work decently, there's no provision to replace "hits," or noise-destroyed lines of video, with the previous line. That technique is standard in VCRs and is present in various computer image systems, and I wish it were available here. Of course, you could load the image into other software to fix it, but it would be a lot more convenient if the capability were included.

The pull-down menus are handy, but, when used without a mouse, they don't allow you to scroll down the options to pick the one you want. Rather, you must select the desired function by its letter. If you try to scroll down the menu, it just rolls up and disappears.

The manual, while fairly complete, is not written for the computer neophyte. Some of the explanations could be more complete, particularly regarding addresses and interrupts, a subject which confuses many people.

"If you've ever wanted to get into SSTV, this is a great way to do it!"

Conclusion

If you've ever wanted to get into SSTV, this is a great way to do it! I hope digitizer hardware comes down in price enough that computer-based systems can include it. Even if you have to buy a separate one, though, the price of a complete computer-based SSTV system is far lower than that of a dedicated scan converter, and the utility is much greater. The Pasokon is the most fun I've had on amateur radio in a long time. I highly recommend it.

Oh yeah, before I forget . . . A demo, receive-only version of the Pasokon system called EZSSTV is available on various computer networks, including the ARRL BBS and the Internet. It won't save pictures to disk, and it only supports a couple of the modes, but you can get your feet wet with a simple, one-chip, home-brewed interface and see how much fun SSTV is. There's also an SSTV primer from the same sources. Happy video, and I'll *see* you on the bands! 73

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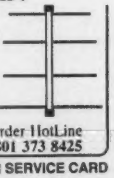

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by Peter H. Putman KT2B

Maldol USA
4711 NE 50th
Seattle WA 98105
Telephone: (206)-525-9158
Price Class: HS-2 144 MHz yagi, $54.99 (MSRP);
Maldol HS-75 440 MHz yagi, $54.99 (MSRP)

Maldol Antenna's HS-2 and HS-75

Check out this pair of lightweight VHF/UHF yagis.

Yagi antennas are everywhere—HF, VHF, UHF, log periodics, monobanders, duobanders, and even triband yagis are everyday fixtures in many amateur radio stations. While most hams who use Yagis probably have fairly large models permanently attached up on a tower or roof support, there are times when a small, portable yagi comes in real handy—especially when operating at VHF and UHF frequencies. Such instances could include foxhunts, temporary emergency or special event stations, and remote links for repeaters and packet stations.

One recent entry into the small yagi market is Maldol Antennas of Japan, who has designed a couple of lightweight beams for portable use. Maldol had a large, eye-catching display at the 1994 Dayton Hamvention featuring an array of yagis and omnidirectional antennas for a variety of uses. I was intrigued, and after a brief conversation with Jim Smith KA7APJ, the U.S. importer for Maldol, I was able to procure a few test models for review.

The Maldol HS-2

Maldol's HS-2 2 meter yagi is an extremely lightweight (about 1 lb.) three-element yagi intended for direction finding and foxhunting, but has many uses beyond these. It measures a short 44.5" and employs a traditional gamma-match feed with UHF connector (Photo A). What makes the HS-2 of interest is that its boom length will fit in many nylon zipper cases commonly found in camping supply stores, making it a breeze to pack up the HS-2 for portable or backpack operation.

"What makes the HS-2 of interest is that its boom length will fit in many nylon zipper cases commonly found in camping supply stores . . ."

The three elements fasten to the boom with a clever design. Each of them has a threaded bushing centered on the element. You insert each element into the boom and secure it by attaching a washer and wingnut on the opposite side, which makes for a very quick setup (Photo B). All elements and mounting hardware are made from stainless steel for corrosion resistance, but it's not likely that you'll want to leave this antenna permanently mounted outside—the HS-2 is so light that it could be easily damaged during an icestorm or by an ill-timed falling branch.

The driven element has a couple of pieces to assemble to build the gamma match, consisting of a standoff block with a UHF connector and a coaxial sleeve with a tapped

Photo A. The Maldol HS-FOX2 2 meter antenna.

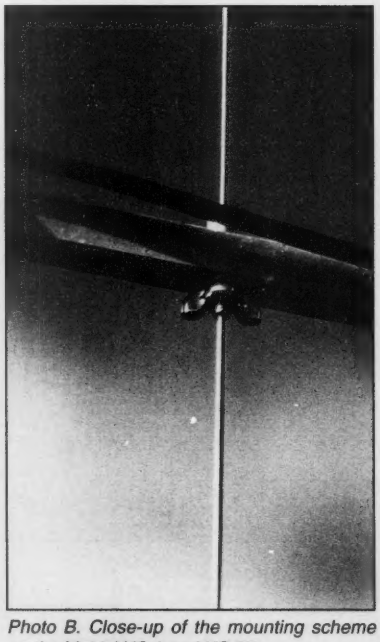

Photo B. Close-up of the mounting scheme on the Maldol HS-2 and HS-75.

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MFJ-284 fits Icom and Yaesu. **MFJ-286** fits Kenwood.

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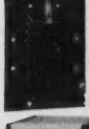

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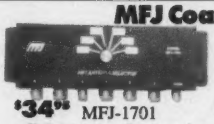

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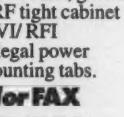

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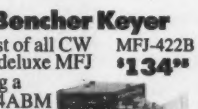

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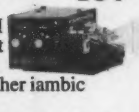

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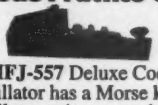

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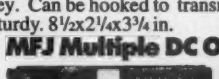

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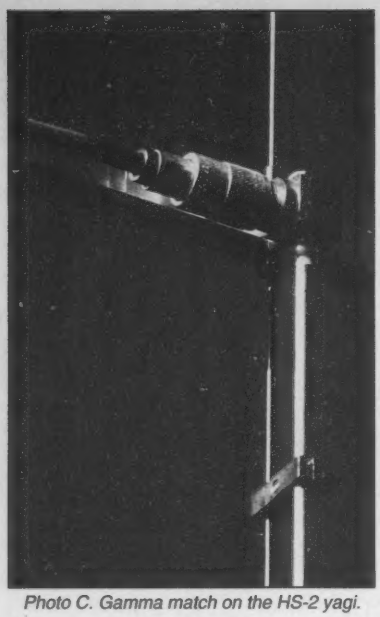

Photo C. Gamma match on the HS-2 yagi.

end that threads into the block (Photo C). Instructions with the yagi give you the correct tap point, but the feed is broad enough that the actual tap point can vary somewhat without problems. The 5/8"-square aluminum boom has two sets of holes drilled in it for the supplied U-clamp, allowing either horizontal or vertical polarization.

Performance

Maldol rates the HS-2's gain at 9.5 dBi (gain over an isotropic dipole). I wasn't in a position to accurately substantiate this number, but I was able to set up a small test range to check the pattern of the antenna as well as its VSWR. This test range was nothing more than a 1/4" radiator on 2 meters mounted atop a ladder at 15' with the HS-2 mounted on 15' of slip-up mast, coupled to an RF millivoltmeter. At this frequency I experienced some ground effects but my results showed them to be negligible.

At 45 degrees either side of center the signal was down 2.5 dB from the reference, while at 90 degrees it was reduced 16.5 dB. This type of plot would be expected for a small yagi like this, meaning that it doesn't have an awful lot of sidelobe rejection. Similarly, the front-to-back ratio clocked in at about 13 dB—not great for contest or weak signal work, but more than adequate for DFing!

When I swept the HS-2 for VSWR, I saw a fairly broad response. Using a Bird 43, the worst reading I came up with was 2.2:1—but that was at 140 MHz. At 144 MHz, the HS-2 dropped down to 1.5:1 and at 146 MHz the reading was less than 1.05:1. It only climbed as far as 1.3:1 at 148 MHz, so this antenna may also appeal to CAP operators. Maldol lists the maximum power at 50 watts and, given the size of the balun sleeve, I think that's conservative.

The Maldol HS-75

Like its 2 meter brother, the HS-75 is a lightweight (less than 1 lb.) antenna designed for quick assembly and portable use (Photo D). It uses the same element mounting system and gamma match design as the HS-2, but employs five elements on a 28.5" boom. The HS-75 has a very small profile and I suspect it wouldn't last too long in a harsh climate as part of a permanent installation. But for portable work it's definitely the ticket, whether you prefer vertical or horizontal mode.

The HS-75 also uses a UHF connector, which I usually frown on at this frequency. However, for DF work, the slight impedance "bump" that results is not going to degrade system performance all that much and makes it easier for people using handie-talkies and mobile radios to connect up.

Performance

Maldol claims 12.15 dBi of gain for the HS-75, not atypical for a yagi of this size. My interest lay in seeing just how sharp the pattern was with the extra three elements. I didn't expect a huge improvement over the three-element HS-2, but was pleasantly surprised: At 45 degrees from the test 1/4-wave antenna, the signal was down 10.5 dB. At 90 degrees, it was reduced 13.5 dB, and the front-to-back ratio was 17.5 dB—definitely a winner for foxhunting.

"Like its 2 meter brother, the HS-75 is a lightweight (less than 1 lb.) antenna designed for quick assembly and portable use."

The VSWR response showed a fairly even curve with a gentle slope up at 440 and 450 MHz, measuring just about 2:1 at these two points. Maximum resonance occurred at 445 MHz—right in the middle of the band, the Bird 43 showed less than 1.05:1. At 443 and 447 MHz, it climbed to 1.5:1 and at 441/449 MHz, I saw about 1.8:1. The HS-75 shouldn't present loading problems to any HT or mobile rig.

How They Worked in the Field

The acid test for these antennas was to put them to work in an actual foxhunt. Local hams from the Warminster ARC had organized such an event, and I loaned them the HS-FOX2, some short lengths of coax, and a few precision stepped-attenuator boxes. Since this was the club's first shot at a DFing event, many of the participants decided to "wing it" as far as receivers, antennas, and other DF equipment. As things turned out, the folks who borrowed the HS-FOX2 were the first to locate the "fox." They were quite pleased with the ease of assembly and lightweight design—noticeably lighter than other well-known small yagis. Comments were also made about the pattern not being terribly sharp, but in conjunction with the step attenuators (providing up to 60 dB in signal reduction), the signal peaks were easy enough to detect.

For the final test, I brought both yagis with me on a short portable operation for the June VHF QSO Party. While many backpackers usually carry a very small station, such as one radio and antenna, I've packed as many as five bands for a mountaintop operation. While the HS-FOX2 certainly made things lighter, its pattern just wasn't sharp enough for making long-haul contacts. The extra six elements on my Tonna made a *big* difference.

For 440 MHz operation, the HS-75 didn't quite compare with my nine-element Tonna—both are fairly broad, but there was an advantage to the Tonna on really weak signals. Also, the tap point on the gamma match required readjustment to reduce the SWR at 432 MHz, while the Tonna uses a folded dipole and is more broadband. For casual weekend contesters, these two antennas are more than adequate, but for a serious QRP portable operation you'll want to try something more substantial. 73

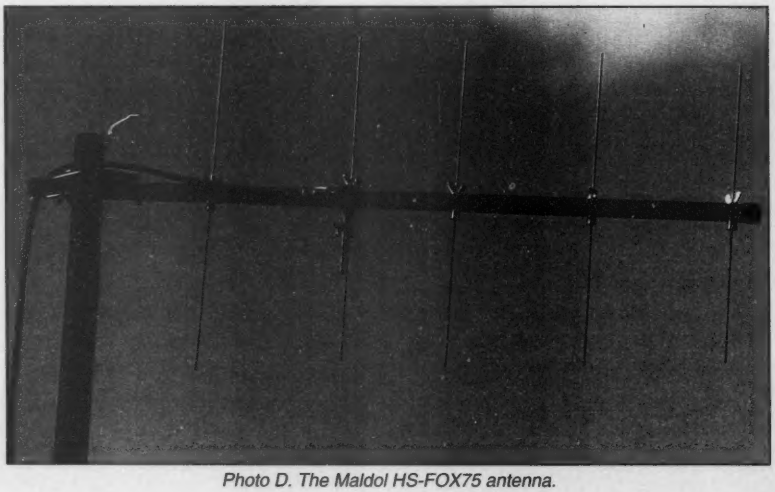

Photo D. The Maldol HS-FOX75 antenna.

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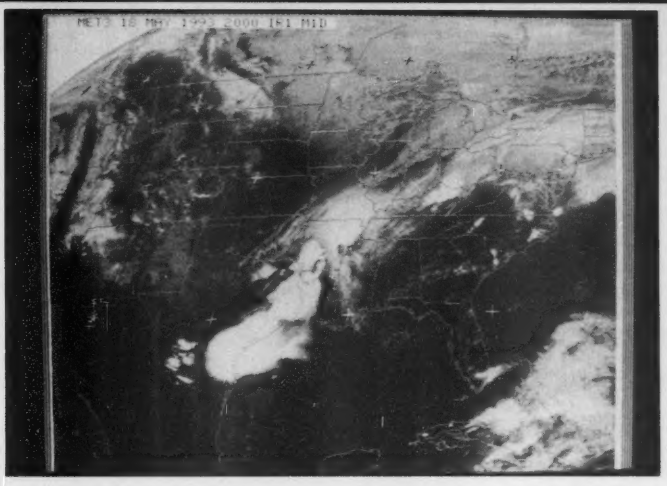

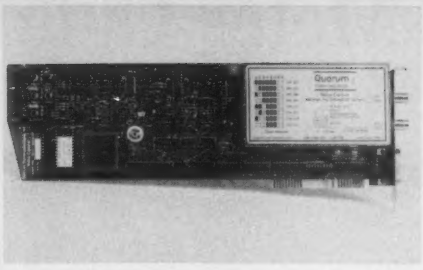

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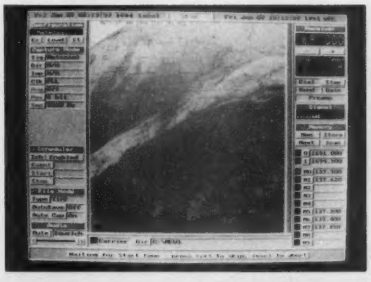

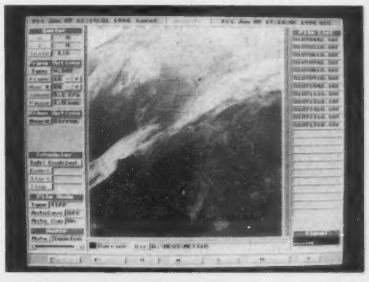

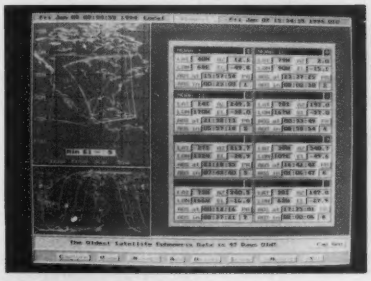

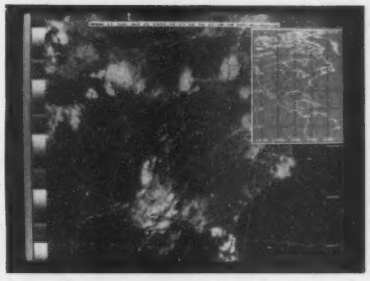

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CIRCLE 257 ON READER SERVICE CARD

2 Meter Collinear Vertical Antenna

Build almost 6 dB of gain for almost $10.

by Marty Gammel KAØNAN

Since my article about the 440 MHz PVC omnidirectional antenna was published in the November 1994 issue of *73 Amateur Radio Today* (page 22), I have had over 30 requests for the 2 meter version of that antenna. So, this article describes how to make my 2 meter version. Due to the wind load from the large sizes of PVC pipe needed to enclose the antenna, the 2 meter version can't be put inside PVC pipe—too cumbersome. You would need 4" inside diameter PVC pipe for the center section.

This collinear antenna is normally mounted vertically for FM voice and packet use. The antenna has almost 6 dB of gain and is fairly broadbanded. You should be able to obtain all the needed materials for under $10, except for the coaxial feedline of your choice.

The idea for this antenna is an old one. I saw a sketchy plan in the 1974 *ARRL Handbook*, and I knew I could improve on it using modern materials and techniques. I changed the dimensions to make the SWR dip at the center of the 2 meter band. I also changed the feed point attachment and tuning design.

Cutting and Assembling the Antenna

Start by gathering all the materials and tools needed. Cut two pieces of 1/2" copper pipe to a 37-1/2" length, two pieces of 1/2" copper pipe to a 19-1/2" length, and one piece of 1/2" copper pipe to a 2" length. Using flux, assemble the 1/2" copper pipe pieces with the 1/2" copper elbows, and place a 1/2" copper cap on each vertical end. Now fire up your propane torch, and sweat solder all the joints. (The excess flux will be cleaned up later). *Hint:* I put a weight on the pieces to keep them in alignment as they are being soldered. Hang the joint that you are currently soldering out away from your work table to avoid burning your house down.

Drill two holes in each of the vertical sections (see Figure 1), and attach the 1/4" x 1" x 6" piece of Plexiglas (I used 1/2" Plexiglas that I had in my junk box) to the antenna using 1/8" x 1" stainless steel bolts with nuts and washers. Install the PVC cap on the top of the 1" PVC mast. Lay the antenna with its Plexiglas standoff pieces on the PVC pipe, and drill two holes in each piece for attaching to the mast, using 1-1/2"-long stainless steel bolts with nuts and washers.

Making the Phasing Section

To complete this antenna, you also need to make a 52-ohm phasing section, one electrical half-wavelength long (see Figure 2). For mine, I used RG-8 that had a velocity factor of 0.80 times a half wave, equaling a needed finished length of 30-1/2". If you use a 0.66 velocity factor, you will need a 25" finished length of 52-ohm coax. If you use a 0.78 velocity factor, you'll will need a finished length of 29.64". Start with a piece of coax about 3" longer than your finished length to allow neat pigtailing of the ends. Twist all the shields together neatly, and then solder them together (see Figure 1 and the photos). Set this phasing section aside until you have finished constructing the antenna.

Cleaning and Finishing the Antenna

You should clean the entire surface of the completed antenna with solvent. Then spray two or three coats of a clear lacquer exterior finish to keep the antenna looking nice and to seal the surface from the weather. I attached the antenna to the PVC mast before spraying the finish. That way the finish coats the nuts and bolts to keep them looking nice, too.

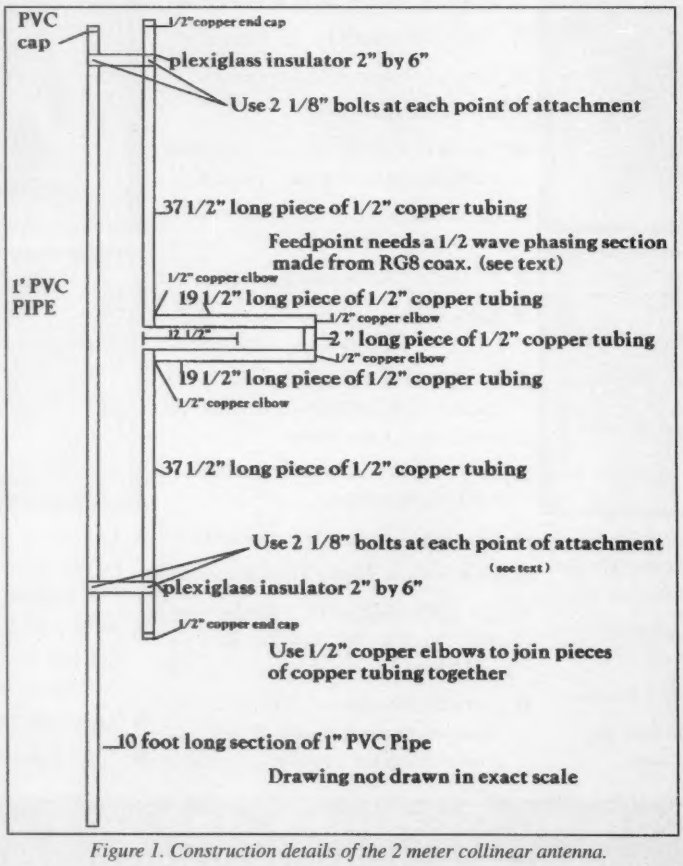
PVC cap
1/2" copper end cap
plexiglass insulator 2" by 6"
Use 2 1/8" bolts at each point of attachment
37 1/2" long piece of 1/2" copper tubing
Feedpoint needs a 1/2 wave phasing section made from RG8 coax. (see text)
1' PVC PIPE
1/2" copper elbow
19 1/2" long piece of 1/2" copper tubing
1/2" copper elbow
2 " long piece of 1/2" copper tubing
1/2" copper elbow
19 1/2" long piece of 1/2" copper tubing
1/2" copper elbow
37 1/2" long piece of 1/2" copper tubing
Use 2 1/8" bolts at each point of attachment
(see text)
plexiglass insulator 2" by 6"
1/2" copper end cap
Use 1/2" copper elbows to join pieces of copper tubing together
10 foot long section of 1" PVC Pipe
Drawing not drawn in exact scale

Figure 1. Construction details of the 2 meter collinear antenna.

Attaching the Phasing Section

The center conductor of your main feedline and one end of the phasing section connect to the upper feed point. Solder this neatly, as it will be clamped to the antenna when tuning. Tin the other end of the phasing section, and attach this to the lower feed point with a clamp. Tape the phasing section and the feedline together, and bring the completed coax phasing section over to the PVC mast *after* tuning the antenna.

Tuning the Completed Antenna

This antenna is very easy to tune. All you have to do is slide the phasing section-feedline assembly along the horizontal 1/2" copper tubing until you have found the lowest SWR point. For mid-band, this measurement should be about 12-1/2" from the vertical sections of 1/2" copper tubing. (See the figures and photos.)

After the lowest SWR has

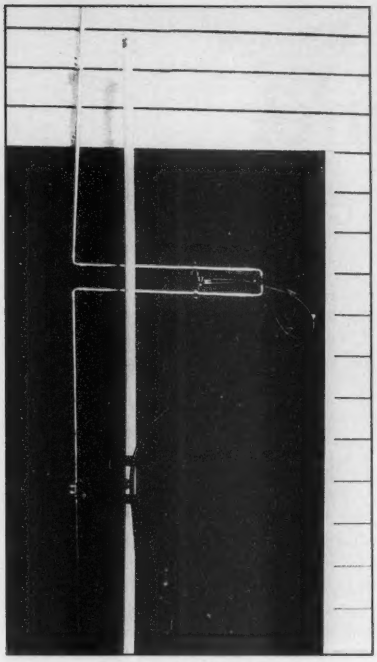

Photo A. The completed 2 meter collinear.

been found, use some plastic tie-wraps to secure the coax and phasing section to the mast and antenna.

Builder's Notes

I used a clean rag soaked with lacquer thinner to clean the antenna before applying the clear exterior finish.

Tape the phasing section and coax to the antenna for tuning. Add the plastic tie-wraps after the antenna is completed.

Trim excess length off the tie-wraps before putting the antenna on your roof or tower.

ABS type plastic pipe can be used instead of PVC pipe. I didn't use a wooden mast, avoiding the warping, shrinking, and swelling of wood.

Keep the antenna at least a half-wavelength away from metal to avoid any detuning from close masses of metal or wires.

I used the "solder the phasing section to the feedline" method of feeding the antenna to avoid any extra coax fittings adding their losses to the antenna system.

A convenient length of 52-ohm coax, 8 to 10 feet long, with a coax fitting on one end, may be attached to the phasing section to make installation easier. I had a 60-foot run of coax and didn't want any extra joints in the feedline run into my shack.

If you are going to mount this antenna in a roof tripod, you may want to slip a wooden dowel or closet rod inside the lower section of the mast to add strength to the mast.

Anyone wanting more information may write to me directly (1703 Hewitt Ave. W., St. Paul, MN 55104-1128), sending an SASE (a #10 business size works best). I will answer all requests sent this way. Good luck on your antenna project, and happy hamming—73.

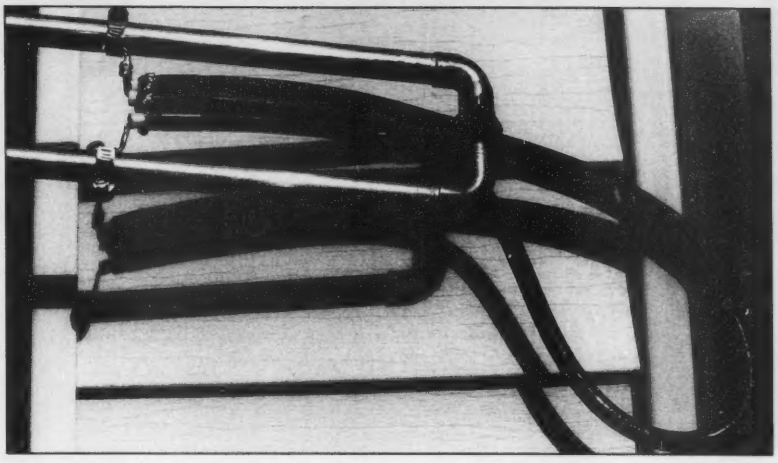

Photo B. Detail of the half-wavelength phasing section.

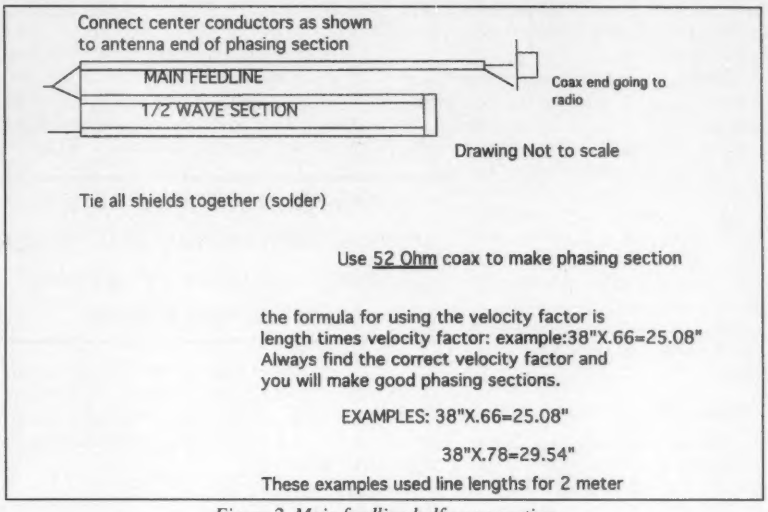
Connect center conductors as shown
to antenna end of phasing section
MAIN FEEDLINE
1/2 WAVE SECTION
Coax end going to radio
Drawing Not to scale
Tie all shields together (solder)
Use 52 Ohm coax to make phasing section
the formula for using the velocity factor is
length times velocity factor: example:38"X.66=25.08"
Always find the correct velocity factor and
you will make good phasing sections.
EXAMPLES: 38"X.66=25.08"
38"X.78=29.54"
These examples used line lengths for 2 meter

Figure 2. Main feedline half-wave section.

Parts List

1/2" Schedule M copper tubing:	
2 pieces	37-1/2" long 1/2" copper tubing (for vertical sections)
2 pieces	19-1/2" long 1/2" copper tubing (for horizontal sections)
1 piece	2" long 1/2" copper tubing (for center stub)
4 pieces	1/2" copper elbows (for attaching tubing together); see drawing/photo
2 pieces	1/2" copper end caps (for top and bottom of vertical sections)
PVC plastic pipe and fittings:	
1 piece	1" PVC pipe 10 feet long (for mast)
1 piece	1" PVC cap (for the top of the mast pipe section); see drawing/photo
Plexiglas or other non-conductive material:	
2 pieces	1/4" thick by 1" wide by 6" long (for attaching antenna to mast)
Miscellaneous items:	
4	1/8" by 1-1/8" stainless steel bolts with nuts (for attaching antenna)
4	1/8" by 1-3/4" stainless steel bolts with nuts (for attaching antenna)
2	3/8" wide by 7/8" diameter stainless steel hose clamps (for feed point)
Some plastic tie-wraps (for securing coax and phasing section)	
Silicone or other sealing compound (to weatherproof coax connections)	

Tools needed:
Plumber's-type tubing cutter
Propane torch
Tape measure
Wrenches
Electrical tape
Solder and flux

A Decibel Primer

Simple math for the Technician Class.

by Steven R. Sampson N5OWK

If you ask a Technician what a decibel is, you may find someone on the hot seat. Shifting and squirming, they may finally proclaim: "It's a measurement system." That part is obvious, but not really the answer we are searching for.

The decibel system of measurement is often confusing. A trick we use with metric measure, for example, is to memorize a conversion constant. This technique will also work well for decibels. Rather than just leave you hanging with three numbers to memorize, I would like to introduce some real world examples and the underlying math. I think you will enjoy how simple decibels really are, and how the use of this measurement system will fit into your radio and electronic activities.

Heaven's Bels?

In Babylonian mythology, Bel is the god of heaven and earth. Our bel was a mere mortal: Alexander Graham Bell. The bel is defined as the logarithm of the ratio of two levels of power.

$$\text{bel} = \log (P_2/P_1) \qquad \text{(Equation 1)}$$

We use logarithms so that the gain or attenuation of multiple sections can be added and subtracted, rather than multiplying or dividing. It's a handy feature of multiplying exponential numbers where, given a common base, it turns out that we can just add the exponents together. In electronics we use exponents with a base of 10. This really amounts to human simplification, since computers and calculators do not really get all that upset over fractions or multiplication. The function of algebra and trigonometry training is to recognize and manipulate equations to their simplest form. I could type into my calculator "10 to the 2nd power, times 10 to the 2nd power," and get an answer; or, I could also recognize that there is a common base of 10, and just type in 10 to the 4th power after first adding the two exponents.

A bel turns out to be a small fractional number. This is hard to work with, so we multiply it by 10 to improve accuracy, and call it a decibel, abbreviated "dB."

$$\text{dB} = 10 \log (P_2/P_1) \qquad \text{(Equation 2)}$$

For example, the value 1.4445 bels may be prone to rounding of the fractional part. A person might just say 1.5 bels is close enough. They would only be introducing an error of 4% into the measurement. By multiplying the bel ratio by 10, to produce decibels, we get 14.445 decibels. Now, if the number is rounded to 14.5 decibels, we can prevent significant errors from creeping in (0.4% here).

"The function of algebra and trigonometry training is to recognize and manipulate equations to their simplest form."

Using Decibels

Amateurs often use dB to express power loss in coaxial cable. The more advanced may even describe transmitter power or receiver gain in decibels. Most of the radar systems I worked on in my military career specified all measurements to 1 milliwatt. This system uses the abbreviation of dBm, with 0 dBm being equal to 1 milliwatt (0.001 watts). All my coaxial cables of any length were measured, and the input and output power of each stage were adjusted to specifications given in dBm. The reason for this is that an engineering team designing a multistage power amplifier system must know what the previous stage will provide, and the next stage will require. They can use any measurement system they want, but they usually choose one that can have its measurements added. If the target amplifier is 90 dBm and the first stage outputs 10 dBm, they know that they need 80 dBm of amplification in the intermediate stages.

Coaxial cable and waveguide loss are also important. If the waveguide shows a 1 dBm loss and the input expects 10 dBm, then the previous stage will need to be adjusted for 11 dBm output to compensate.

The examples above demonstrate absolute measurements. Zero dBm is 10^0 (which is 1) times 0.001 watt; 10 dBm is 10^1 times 0.001 watt; 90 dBm is 10^9 times 0.001 watt, or 1 megawatt. The use of dB without a reference is a relative measurement. If I tell you the amplifier has a gain of 8 dB, there is no way you can ever know whether the output is a milliwatt or a megawatt. We do know that it will amplify any input by 10 raised to the 0.8 power, or about 6.3 times the input.

Before calculators became as common as watches, there were conversion factors that needed to be memorized: 10 dB, 3 dB, and 1 dB. (See Table 1.) All expressions in dB were reduced to these factors. To factor 8 dB, we would do the following:

8 dB = (3 dB) + (3 dB) + (3 dB) + (-1 dB)
8 dB = 2 x 2 x 2 x 4/5
8 dB = 8 x 4/5
8 dB = 32/5

You always use a method where the 1 dB figure can be used the least number of times. It is the most inaccurate conversion value of the three. The conversion constant method results in an answer very close to the calculator answer. Here the answer is 6.4, which is an error of 1.4% to the calculator answer of 6.3096.

Mental Gymnastics

If you go to a club meeting and mention 8 dB to any seasoned ham over age 40, you will probably see their eyes blink as they perform this mental miracle. When the conversation proceeds and the person states that the amplifier put out 4 watts originally, you now have a reference and can convert to an absolute measurement. You now know that 8 dB of gain is about 25.6 watts (6.4 times 4 watts). Using a calculator you could much more easily type 10 to the 0.8 power times 4, and get the more accurate answer of 25.2383 watts.

The entire table for converting decibels into real numbers is shown in Table 1. You

may wish to memorize it for emergency use.

Our first experience with logarithms is normally in algebra class. You may have noticed above that I wrote most equations in logarithmic form, but then I went on and described examples shown in exponential form. I did so because I know that we use base 10 in most electronic measurements. But let's take the equation as it comes, and show how the log function forms a tool to generate numbers that can be added or subtracted.

We often must calculate dB when given power measurements. The earlier example of an amplifier with 4 watts input and 25.6 watts output can also be converted to dB using the logarithmic form. Here we divide the output 25.6 by the input 4 (which we already know is 6.4) and take the log of this ratio. The answer is 0.8062 bels, or 8.062 decibels:

8.062 dB = 10 log (25.6/4) (Equation 3)

The log function provides us with the power we need to raise the (understood) base of 10 to get this ratio. You could also use a logarithm table and look up our ratio of 6.4 and find this same 0.8062 value.

This technique is also used when converting power to dBm. In this case, the measured power is divided by the reference power of 0.001 watts:

dBm = 10 log (watts/0.001) (Equation 4)

The Plus and Minus of It

The purpose, as we mentioned at the start, is to be able to add or subtract the gains or attenuation measurements together. If we keep a common base of 10 throughout, we can add or subtract the exponents. Thus, the logarithm function provides us with a tool where you insert any value, turn the crank, and it will generate an exponent that the common base 10 must be raised to. This exponent can be added to every other exponent it generates due to this common base. All the decibel measurement conversion of a bel does for us is multiply the values by 10, providing us with whole numbers rather than fractions. This is used to maintain instrument accuracy even when rounded. The difference between a bel and a logarithm is that the bel is understood to be a ratio of two powers, while a logarithm value by itself is undefined— it's just a number.

"With a little practical experience, each of us can easily describe the need for and function of this valuable measurement system."

No Squirming

I do not like to squirm when explaining decibels. With a little practical experience, each of us can easily describe the need for and function of this valuable measurement system. While memorization of decibel conversions is useful in light conversation, the calculator provides a much better method of turning the crank on decibels. I think it is much easier to type 10 to the 0.8 power into a calculator than to convert 8 dB to a real number using conversions (3 dB + 3 dB + 3 dB - 1 dB), but I'll let you decide. Quickly now, first convert 50 watts to dBm. Second, tell me how much power in dBm and watts a 4-watt transmitter will produce at the antenna of a receiver 10 miles away. Each of the two antennas have 11 dB of gain. Assume a 110 dB path loss. (The answers should be 46.99 dBm, -51.98 dBm, and 6 nanowatts). 73

Number of dB	More (Positive)	Less (Negative)
1 dB	5/4	4/5
3 dB	2	1/2
10 dB	10	1/10

Table 1. Table for converting decibels into real numbers.

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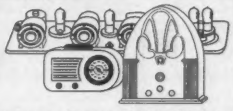

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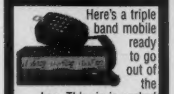

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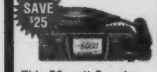

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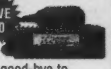

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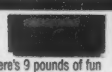

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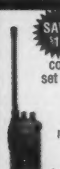

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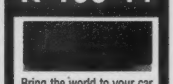

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DTMF Decoder

High-speed home-brew DTMF control.

by Richard Taylor K7CAH

The Capitol Peak Repeater Group operates several repeaters on Capitol Peak near Olympia, Washington. These repeaters are controlled by two microprocessor controllers, with lots of bells and whistles, including an autopatch. There are over 600 user and control codes involved in the setup and operation of the two controllers. Due to the large number of DTMF codes involved in setup, configuration, and user operations, a fast means of inputting DTMF was clearly needed (see "DTMF Computer Interface," *73* magazine, December 1994). Also, a way was needed to keep track of all the codes that were sent to the repeaters.

The following DTMF decoder will decode all 16 digits and date- and time-stamp the received code. It uses the printer port of any IBM-compatible computer. Although the decoder will work with the XT series computers, they are too slow to properly decode the fast digits generated by memory-stored codes of the newer radios. A 286 or higher computer is recommended.

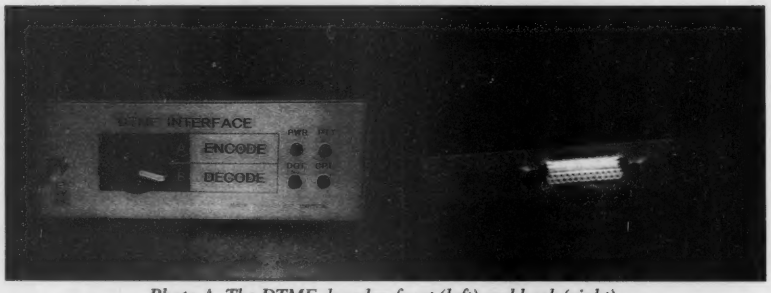

Photo A. The DTMF decoder, front (left) and back (right).

Circuit Description

The decoder was designed around the CD22204 DTMF receiver chip. It uses a standard 3.58 MHz TV-type crystal in its oscillator and has four binary data lines out.

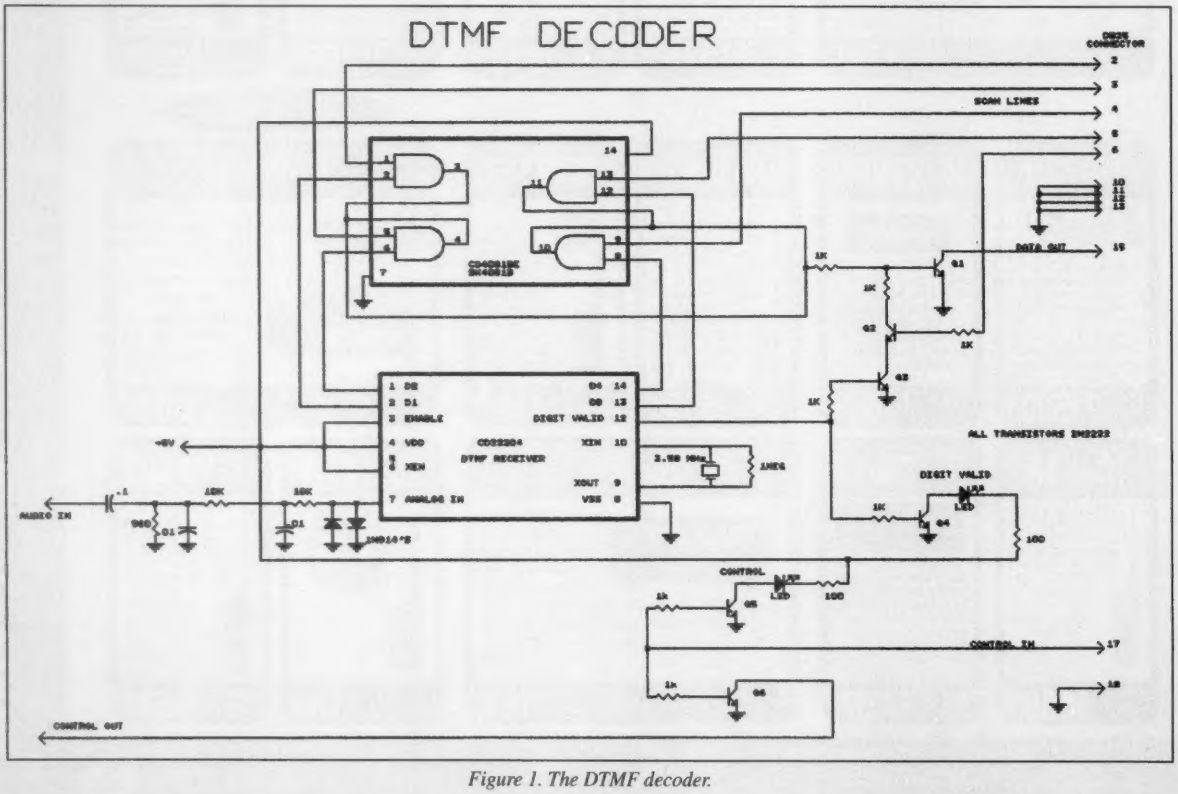

Figure 1. The DTMF decoder.

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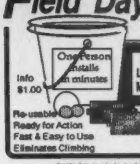
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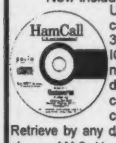

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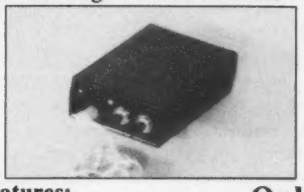

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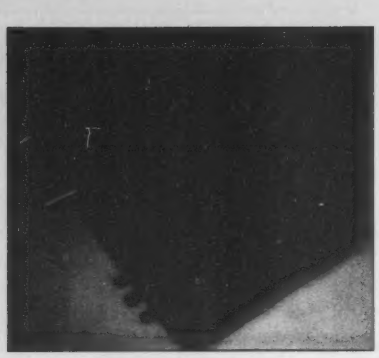

Photo B. Inside the box.

PRINTER PORT

PIN	DESCRIPTION
1	STROBE
2	DATA BIT 0
3	DATA BIT 1
4	DATA BIT 2
5	DATA BIT 3
6	DATA BIT 4
7	DATA BIT 5
8	DATA BIT 6
9	DATA BIT 7
10	ACKNOWLEDGE
11	BUSY
12	PAPER OUT
13	PRINTER ON LINE
14	AUTO FEED
15	ERROR
16	INIT
17	SLCT
18–25	GROUND

PORT ADDRESS

LPT1 - 888 OR 956
LPT2 - 632

PORT ADDRESS ACCESSES PINS 2 TO 9	OUTPUT
PORT ADDRESS + 1 ACCESSES PINS 10,11,12,13,15	INPUT
PORT ADDRESS + 2 ACCESSES PINS 1,14,16,17	OUTPUT

Figure 3. Printer port pinout and addressing.

The output lines represent the binary value of the received DTMF digit. When I first started this project, it seemed simple enough. Just take the binary output from the chip, put it in the parallel printer port, and write the program code to handle the binary input. But, I quickly found out that each computer handles the input lines of the printer port a little differently. In the end, I had to change the parallel binary out from the receiver chip to serial binary and input that to the printer port. Using serial data, we don't care what numbers are returned by the computer. All that matters is whether the input pin 15 is in a high or low state. This still keeps the hardware simple, but the program code becomes a little more complex.

The output lines from the CD22204 DTMF receiver chip represents the parallel binary value of the received DTMF digit. These data lines are tied to one input each of four AND gates (see Figure 1). The other input to the four AND gates is controlled by the data out lines of the printer port. The output from the AND gates is tied together and trigger Q1 on and off. This sends the resulting data to the computer via the printer error line pin 15.

The program turns the printer data lines 2 through 6 on and off in sequence. This, in effect, forms a scanner that scans the parallel binary output from the receiver chip and converts it to serial binary through the AND gates and Q1. However, with only four lines of binary output from the receiver chip, only 15 DTMF digits can be decoded. The 16th digit (D) is decoded as all output lines low and the digit valid line high. Q2 and Q3 form another AND gate that inputs the digit valid line into the serial output stream.

When the program detects a user-defined code, line 17 goes high. This causes Q6 to conduct, grounding the control out line. This line can be used to control external devices (turn on the speaker, turn on a light, etc.) when your private code is received. Caution: Q6 can only handle about 500 mA. Use an external relay to handle anything above this current (see Figure 2).

Q4 and Q5 are used as drivers for the LEDs. The digit-valid LED lights whenever a DTMF tone is recognized. The control LED lights when the user-defined control code is decoded.

The Program

The program is written in GWBASIC and should run on any IBM-compatible computer. The listing contains two parts. The first part controls the input and output lines of the printer port (Figure 3). The second part decodes the binary digit, date- and time-stamps it, and prints it to the screen.

Not all computers, however, use the same port address for the printer port. The port address for LPT1 should be 888 or 956. For LPT2, it should be 632. Line 30 of the program determines the correct port address. If the program will not run, change the value of W in line 30.

Line 580 of the program determines the user-defined code that turns on the control out line. Change the value of D$ to any code you wish. Don't forget the quotes. When the program first detects this code, it will turn the output line on. The next time it detects this code it will turn off the output line.

Construction

Parts placement is not critical. All transistors are 2N2222s, although any general-purpose NPN switching transistor should work. Although parts values are also not critical, it is best to stay as close as possible to those listed. The components from the audio in line to pin 7 of the receiver chip comprise an audio filter to prevent falsing on voice peaks. However, the 1N914 diodes may be

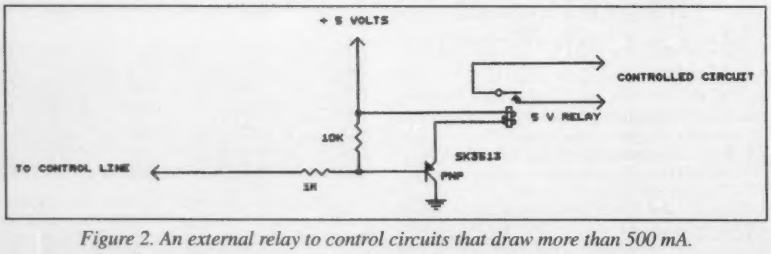

Figure 2. An external relay to control circuits that draw more than 500 mA.

Parts List

1	DTMF receiver, CD22204
1	Quad AND gate, CD4081BE or SK4081B
6	2N2222 transistor or equivalent
1	3.5795 MHz TV color burst crystal, ECG358 or equivalent
7	1k ohm resistor
2	100 ohm resistor
2	10k ohm resistor
1	560 ohm resistor
1	0.1 µF capacitor
2	0.01 µF capacitor
2	1N914 diode
2	Red LED

A complete program with user data base, code recognition, file storage, and documentation is available on 5-1/4 disk for $15 U.S. from the author. Write to me at 613 N. 5th, Tumwater, WA 98512.

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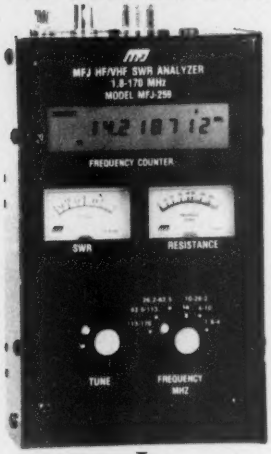

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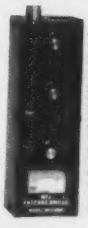

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PROGRAM

```
10 REM DTMF DECODER BY K7CAH
20 CLS:H=0:CTRL=0:KEY OFF
30 W=888:REM                  PRINTER PORT ADDRESS
40 OUT W,0:REF=INP(W+1)
50 PRINT"                                DTMF DECODER"
60 PRINT"________________________________________________________________________________"
70 B$=INKEY$
80 DIGIT$="":N=1:A$="":OUT W,0
90 IF N>16 THEN 290:REM STOP SCAN AND CHECK DIGITS
100 OUT W,16:REM START SCAN ON VALID DIGIT
110 IF INP(W+1)<>REF THEN HOLD$="":GOTO 230
120 OUT W,N:REM SCAN DIGIT LINE
130 B=INP(W+1)
140 IF B=REF THEN A$="0":GOTO 170
150 IF B=REF+1 OR B=REF-1 THEN A$="0":GOTO 170
160 IF B<>REF THEN A$="1"
170 DIGIT$=DIGIT$+A$
180 N=N+2
190 IF N=3 THEN N=2
200 IF N=6 THEN N=8
210 IF N=10 THEN N=16
220 GOTO 90
230 IF B$="Q" OR B$="q" THEN KEY ON:END:REM QUIT
240 IF B$="C" OR B$="c" THEN 20:REM CLEAR SCREEN
250 REM IF TIME > 4 SEC CHECK FOR CODE AND PRINT NEW LINE
260 IF TI+4=VAL(RIGHT$(TIME$,2)) AND H=1 THEN GOSUB 580:H=0:CODE$="":PRINT
270 GOTO 70
280 REM IF DIGIT IS HELD DOWN THEN PRINT ONLY ONE DIGIT
290 IF HOLD$=DIGIT$ THEN 230
300 REM TEST DIGITS
310 IF DIGIT$="10000" THEN GOSUB 530:PRINT "1";:C$="1":GOSUB 490:GOTO 230
320 IF DIGIT$="01000" THEN GOSUB 530:PRINT "2";:C$="2":GOSUB 490:GOTO 230
330 IF DIGIT$="11000" THEN GOSUB 530:PRINT "3";:C$="3":GOSUB 490:GOTO 230
340 IF DIGIT$="00100" THEN GOSUB 530:PRINT "4";:C$="4":GOSUB 490:GOTO 230
350 IF DIGIT$="10100" THEN GOSUB 530:PRINT "5";:C$="5":GOSUB 490:GOTO 230
360 IF DIGIT$="01100" THEN GOSUB 530:PRINT "6";:C$="6":GOSUB 490:GOTO 230
370 IF DIGIT$="11100" THEN GOSUB 530:PRINT "7";:C$="7":GOSUB 490:GOTO 230
380 IF DIGIT$="00010" THEN GOSUB 530:PRINT "8";:C$="8":GOSUB 490:GOTO 230
390 IF DIGIT$="10010" THEN GOSUB 530:PRINT "9";:C$="9":GOSUB 490:GOTO 230
400 IF DIGIT$="01010" THEN GOSUB 530:PRINT "0";:C$="0":GOSUB 490:GOTO 230
410 IF DIGIT$="11010" THEN GOSUB 530:PRINT "*";:C$="*":GOSUB 490:GOTO 230
420 IF DIGIT$="00110" THEN GOSUB 530:PRINT "#";:C$="#":GOSUB 490:GOTO 230
430 IF DIGIT$="10110" THEN GOSUB 530:PRINT "A";:C$="A":GOSUB 490:GOTO 230
440 IF DIGIT$="01110" THEN GOSUB 530:PRINT "B";:C$="B":GOSUB 490:GOTO 230
450 IF DIGIT$="11110" THEN GOSUB 530:PRINT "C";:C$="C":GOSUB 490:GOTO 230
460 IF DIGIT$="00000" THEN GOSUB 530:PRINT "D";:C$="D":GOSUB 490:GOTO 230
470 GOTO 230
480 REM FORMULATE CODE FOR OUTPUT
490 HOLD$=DIGIT$
500 CODE$=CODE$+C$
510 RETURN
520 REM DATE AND TIME STAMP
530 IF H=0 THEN PRINT "    ";DATE$;"    ";TIME$;"    ";:H=1
540 TI=VAL(RIGHT$(TIME$,2))
550 IF TI=59 THEN TI=0
560 RETURN
570 REM CODE FOR OUTPUT CONTROL
580 D$="123":REM CODE TO TRIGGER OUTPUT LINE
590 IF CODE$=D$ AND CTRL=0 THEN OUT W+2,3:CTRL=1:GOTO 610:REM OUTPUT LINE ON
600 IF CODE$=D$ AND CTRL=1 THEN OUT W+2,13:CTRL=0:REM OUTPUT LINE OFF
610 RETURN
```

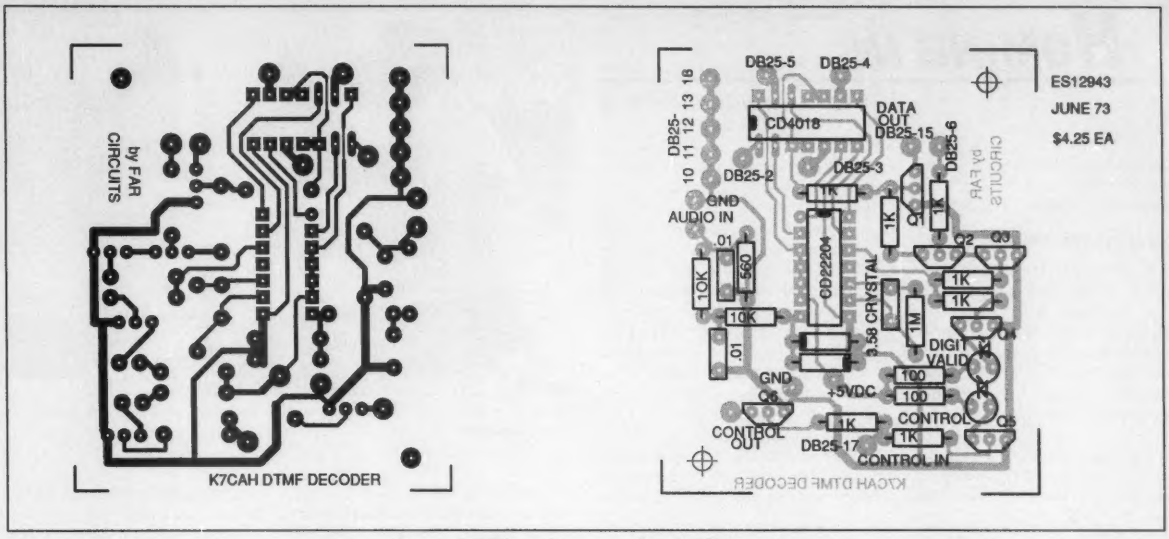

Figure 4. PC board layout and parts placement.

left out for increased sensitivity. Pins 10 through 13 and pin 18 of the printer port must be grounded for the decoder and program to function properly.

I used a computer A/B switch box as an enclosure. The type with the DB-25 connectors works really well. It already has the connectors and switch wired. One port was disconnected and wired to the decoder board. The other port can be left as is and used for the printer.

Any source of audio may be used. However, the audio input circuit is designed for low-level audio. A good source for this audio is the output jack on the back of the radio for packet. If speaker audio is used, too high a level will cause distortion and the decoder will not function properly. If erratic operation is encountered at normal listening levels, add a resistor in series with the audio input of the decoder board.

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Stalking the Wild T

If someone in your ham club invites you to go on a foxhunt or a bunny hunt, don't rush to the phone to call PETA. They won't be harming helpless critters. These contests, which are better known as T-hunts in many places, are quests for hidden radio transmitters. That's what the T stands for.

Typically, one ham puts a low-powered signal with distinctive audio on the air from an unusual location. Other hams try to track it down using simple radio-direction-finding (RDF) equipment. It's fun and educational, as you probably know from reading "Homing In" every month. This time, I'll tell about participating in a different kind of T-hunt, where T stands for "tortoise."

If you watch nature specials on educational TV channels, you are sure to see scenes where "tagged" animals are monitored using RDF. Many of today's research studies are funded by the National Biological Survey (NBS), a federal agency that was opened in November 1993. Among other activities, NBS works with governmental agencies, universities, and private organizations to perform biological research, inventory, and monitoring. An important NBS mission is to provide the Department of the Interior with a biological science base for governmental decision-making. NBS has a technical center, 12 research centers, 78 field stations, and 59 cooperative research units.

No Clues, No Rules

Tracking wildlife with RDF is certainly different from mobiling in search of a hidden ham transmitter. Most clubs have strict T-hunting rules that establish a boundary within which the T must be hidden. Usually the T must be stationary and have a fixed antenna orientation. Transmission lengths range from several seconds to continuous. The signal must be copyable at the hunt's starting point or through the local repeater.

None of these rules apply to wildlife tracking. There is no guarantee you will hear a signal when you start. Animals are free to roam as you track them. They change antenna position with every step or hop. Battery size limits transmission lengths to a fraction of a second.

Despite these challenges, researchers daily plot the exact location of four-legged creatures from mouse-size to moose-size. They also monitor signals from birds in the air and fish in streams. Some are volunteers or work directly for educational institutions, while others are independent consultants.

Though I have corresponded with animal-tracking specialists from time to time, I never had an opportunity to observe their operations firsthand until this spring, when environmental consultant Glenn Goodlett wrote of his experiences on an online service. Glenn got his start tracking rodents in the USA and Australia. Recently, he has worked in a study of tortoises in California's Mojave desert.

As his third annual spring chelonian survey began, Glenn invited me to come and observe. He is not a ham yet, but he is a regular reader of *73 Amateur Radio Today* and "Homing In." "I like learning about the latest technology," he says.

Animal tracking, cataloguing, and data analysis is a full-time job. During the study period, Glenn lives at the research site with his wife, Tracy, another environmental consultant whom he met during a tortoise survey, and whom he married last fall. Rounding out this study team is biologist Paul Frank.

As I arrived, Paul and Glenn were doing a health check on a tortoise they had encountered (Photo A). This one did not have a radio tag, but it was in their database. It had previously been numbered, and the number had been encoded on the animal by notching edges of its carapace (upper shell) according to a standard marking system.

Paul and Glenn checked its respiration, weighed, measured and photographed it, then logged the data before setting it free. They wore fresh surgical gloves so that they would not become carriers, passing diseases from tortoise to tortoise. This one was easy to handle. "It's still kind of cold and they're not very active," Paul told me. "But when it gets a little warmer they can put up quite a fight."

Desert tortoises are not facing extinction, but they are considered to be threatened. "They were listed in 1989 after there was a massive die-off," says Paul. "It was a real interesting situation because there are a lot of them and they have a big range, but so many died so fast that the Fish And Wildlife Service listed them. That produced an amazing amount of work for a lot of people. Virtually any public construction within their range needed a pre-construction survey and population monitoring. A lot of biologists got into it and it seemed like anybody who could live out in the desert could find work. In 1990 and 1991 there were probably several hundred people doing tortoise work. Now there is probably a third of that."

In addition to verifying population levels, the present study seeks data on movements. The basic survey area is one square mile of public land near a busy highway. "The average range of an adult tortoise is about half a mile to a mile," Paul says. "Over time, most of them living along a highway will go out and get run over, so there's a band along each road with very low population."

Photo A. A docile desert tortoise gets a health check from Paul Frank (left) and Glenn Goodlett.

The highway near the study area includes an experimental tortoise fence made of hardware cloth 18 inches high along the regular barbed-wire fence (Photo B). Special fence sections guide animals to culverts where they can safely cross under the road.

To determine if the culverts and fences are working, an experimental solar-powered monitoring system has just been installed on two culverts nearby (Photo C). A sensor detects passage of tortoises and logs the time of each passage and the ID number of the animal. The special tortoise tags for this system are passive (no batteries needed) and are completely separate from the radio tracking system.

According to Glenn, "The culvert sensor is a big loop in the ground, like the primary of a transformer. The animal's tag has a winding that acts like a secondary. When it comes across, enough power is coupled to provide power to the chip inside the tag, which has its number stored in memory. It loads and unloads its coil, and the reader picks up that loading and unloading."

NBS hopes the study will show that tortoise population is increasing near the highway. "With the fence, a lot of new habitat is created," says Paul. "Tortoises are able to move into the area and stay a while. The biggest problem with fencing is the gates. People often do not close them. A tortoise will tend to walk along the fence until it finds an open gate, then go through. One of the things we were doing in another study was to experiment with different kinds of tortoise guards, similar to cattle guards. We wanted something that you could drive a vehicle over but a tortoise will not cross."

On With the Hunt

Now it was time to find more of last

Photo B. Special fences along highways in California's Mojave desert keep tortoises off the road, where death would be almost certain. The white PVC pipe marks part of the survey grid.

Photo C. Environmental consultants Glenn and Tracy Goodlett unlock the desert-proof vault containing a solar-powered tortoise crossing sensor.

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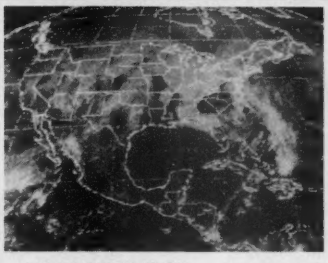

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CIRCLE 188 ON READER SERVICE CARD

Photo D. Biologist Paul Frank shows that simple, rugged equipment is all that is needed for on-foot wildlife tracking. On windy days like this, he usually uses earphones.

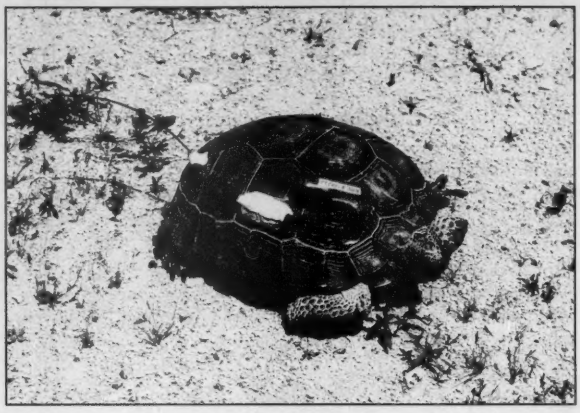

Photo E. This desert tortoise doesn't mind being a perpetual hider for biological T-hunts, all for the sake of science and conservation.

year's tagged turtles. Each transmitter is on a different frequency in VHF "high band" between two meters and TV channel 7. A few commercial manufacturers offer portable synthesized receivers designed for researchers, but Glenn says he has results just as good with less expensive VHF scanners, so long as they include a BFO for SSB/CW detection. Scanners are much smaller and lighter than the special receivers, too. He likes being able to program his scanner such that channel numbers are the same as tortoise numbers, for fast identification of new intercepts.

Glenn uses a Trident TR2400, while Paul tracks with a Sony ICF-PRO80 (Photo D). Both use two-element phased dipole antennas by Telonics, Incorporated (932-T East Impala Avenue, Mesa, AZ 85204). We went to an area where several animals had been living and acquired three signals. I tried out the Sony setup and had so much fun that I didn't stop until I had found all three tortoises. Two were foraging and one was in its shallow burrow.

The phased array antenna has a classic cardioid (heart-shaped) directional pattern. When searching on foot for a tortoise in the open, maximum range is about 3/4 mile. I was surprised how sharp the forward lobe seemed on weak signals. A single 30 dB RF attenuator was all that was needed to knock down the signal as I got within 100 feet or so. No S-meter was needed; we determined signal level easily by ear.

Just as in ham T-hunting, I got incorrect bearings at some points in my pursuit. Perhaps the turtle's antenna orientation was putting a null in the direct signal path, or some object was reflecting the signal. Researchers know that if they keep moving and follow their bearings, they will follow a more-or-less direct path to the animal.

According to Glenn, "The hardest part of the hunt is getting to hear the signal. The rest is relatively easy. They tried triangulating with multiple fixed-site receivers, but the big problem was that not enough of the receivers could pick up the weak signals."

To acquire signals at greater range, Glenn's crew has a long yagi to mount on a mast at the rear of their truck. RDF with small aircraft is also done. "We use two directional antennas, attached to each wing strut, and a selector switch for left, right, or both," he says. "Typically we fly a pattern and we switch the antennas from left to right and back to zero in."

Approximately fifty tortoises have been tagged in this study. Three transmitter models are being used. They are a product of AVM Instrument Company (2356 Research Drive, Livermore, CA 94550), which makes tags for a wide variety of animals. Adult tortoises can easily carry a AA-size lithium battery, which is by far the largest and heaviest component in the tags used on them. At a peak power level of about 1 milliwatt, pulsed 70 times a minute, the tag of (Photo E) will stay on the air for up to two years. The entire T weighs 35 grams and is encapsulated with a desert-proof coating.

"Mercury batteries were the best choice in the past," says Glenn. "But they are now considered hazardous and are banned in California. When the battery dies we send the tag back, they put a new battery in and seal it up."

Glen continues, "We used to cement a metal plate on the tortoise shell and bolt the transmitter to the plate. Now we just mount it directly. We put down a dab of super glue to hold everything in place and fasten it down thoroughly with epoxy cement."

Epoxying an antenna to the tortose shell for its full length would interfere with the animal's growth. Instead, researchers glue sections of tubing to the center of the scutes (plates) on the carapace, with the antenna inside the tubing. As growth occurs between the scutes, the antenna slides within the tubing.

The smallest transmitter (not shown) has a tiny solar panel and is used on juveniles. "They come out of the egg at about 45 millimeters long," Paul says. "The smallest tagged turtles are about 60 mm long. The transmitters don't seem to affect them. We haven't seen any evidence of health or behavioral changes due to the tags."

So far, the study has shown that tortoises are mostly stay-at-homes. According to Paul, "Males are more territorial than females. A young one can get beaten up by a big male, which freaks him out. He will then take off for many miles to find a new territory for himself." Tagged tortoises that leave the survey area continue to be monitored.

"I tried out the Sony setup and had so much fun that I didn't stop until I had found all three tortoises. Two were foraging and one was in its shallow burrow."

NBS hopes its study will show a reversal in the downward trend of the number of desert tortoises. "In the late eighties and early nineties the population crashed," says Paul. "In some areas 70 to 90 percent died. They live to be a hundred years old and take up to twenty years to become sexually active. So they can't reproduce their population any faster than humans can, maybe one percent rebuilding per year maximum."

Paul adds that the biggest predator threat is the raven, which attacks turtle eggs and young. "Raven population is increasing dramatically because of human activity. They are taking out a huge number of juveniles. Desert development, off-road vehicle use, and livestock raising all contribute to the threat."

Radio tags help researchers know the movement and health of animals, but thorough surveys are needed to accurately assess population levels. Glenn explains, "A team takes a square mile, puts it in the grid system and methodically searches each grid, walking back and forth through it about 8 meters apart. Typically these are called 60-day surveys, because you work 60 days and you go over each hundred grids in the square mile twice. This year we're doing a 60-day survey to make an updated estimate of population density. But we already have a good guess because we spend so much time out here."

All Creatures, Great and Small

T-hunting for tortoises in flat country is not too arduous. ("About KØOV's speed," according to the witty hams around here.) I'm sure adrenalin levels go up quite a bit when you're hunting something that moves a lot faster and might decide to hunt you instead. For instance, signals from radio collars are keeping researchers updated on the movements of cougars in the mountainous parts of Orange County, where I live. The big cats are creating controversy as housing areas and freeways push into their habitat and bound their hunting range.

Birds have their own set of tracking problems. They have good radio range when airborne, but migration can take them long distances. Transmitters must be very light and placed very carefully. Right now I am exchanging E-mail with a researcher who wants to discuss ideas for better bird tracking.

If you would like to read more about wildlife RDF, let me know. If there is enough interest, I'll have more on the subject in future installments of "Homing In." Keep your T-hunting news coming, too. Send E-mail via the Internet (HomingIn@aol.com) or CompuServe (75236,2165). Send postal mail to my P.O. box on the first page of this article.

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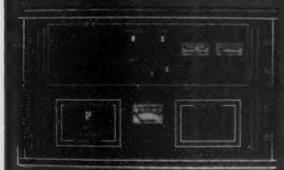

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A Brief Primer on Internet Access

Tuning into the Internet, I've gotten quite a response to my recent call for information about Internet providers. This includes both answers and questions. Based on the questions, I present this brief primer on Internet access.

What is the Internet?

The Internet (note the big "I") is a conglomeration of networks and computers worldwide which are connected together using TCP/IP (Transmission Control Protocol/Internet Protocol). The reason I point out the big "I" in Internet is that any connection that involves two or more networks can be legitimately referred to as an "internet." The "Internet," though, specifically refers to an internetwork developed by DARPA and educational/industry institutions for collaboration.

Today, the Internet is a collection of public and private resources available through ISPs (Internet Service Providers) to anyone with some money to spend—and lately not too much money at that. Note: there are also public access sites that charge no fee. These are usually run by universities or government agencies.

Why Should I Care?

At first, the Internet was the realm of academics and military personnel. It was esoteric and hard to find outside of the academic/military milieu. Because the Internet is now accessible by nearly any computer user, things are different. There are many useful information and communication services which use the Internet as a transport. These services have technical sounding names like Telnet and FTP, but by far the biggest "star" of today's Internet is the World Wide Web (WWW).

The "Web" is a user-friendly, flexible, graphical way to retrieve information. The client side of the Web consists of a web "browser." The browser is an application that understands how to connect to computers on the net that contain information formatted as "Web pages" and display them for you. A good browser can not only provide the pages, but access to other information services such as "gopher" and FTP (File Transfer Protocol). This means that the browser can be your principal connection to the net.

A typical session might be something like this: First you use the "Web Crawler" search engine to locate a ham radio page. The Web Crawler displays a "form" to make the search. It is very simple to use; just type in keywords of interest ("ham radio") into the search box on the screen and press the Enter key.

Your query is sent to the search engine—located on a computer in the Computer Science department of the University of Washington, in Washington State. The search engine has a frequently updated index of the (literally) hundreds of thousands of documents. The results are compiled and then sent back to your browser.

Next to each document in the result is a score of up to 1000 to indicate how closely it answers your query. To look at a document you simply double-click on the document of interest. In our example there are many good looking results, and part of the list looks like this:

```
1000 The New Hampshire Amateur Radio Page
0976 http://ieeesb.eng.mcmaster.ca:70/0h/pages/ham.html
0896 Ham Radio Outlet has Moved
0863 Other QRZ Products
0754 http://www-bprc.mps.ohio-state.edu/cgi-bin/hpp?scanner.html
0704 The Los Alamos High School Ham Radio Club
0701 WHAT IS AMATEUR RADIO?
0692 AB4EL on ThePorch
0541 WB4EJC Home Page
0494 Amateur Radio WWW site of DK0TUI at Technical University of Ilmenau
0482 MegaNet Commercial Web Pages
0446 Other hyperlinks
0431 QRZ Home Page
0431 Bradley University Amateur Radio Club
0428 W5AC Home Page
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Near the middle of the list is a document called "WHAT IS AMATEUR RADIO?"—let's try that one. The result in this case is a text document with no

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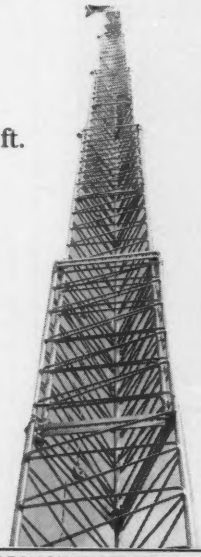

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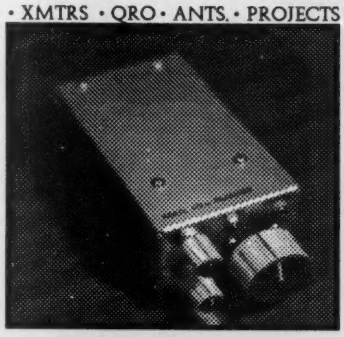

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graphics, though there could easily have been some. The beginning says:

```
WHAT IS AMATEUR RADIO?
A retired military officer in North Carolina makes friends over the radio with a ham in Lithuania. An Ohio teenager uses her computer to upload a chess move to an orbiting space satellite, where it's retrieved by a fellow chess enthusiast in Japan. An aircraft engineer in Florida participating in a "DX contest" swaps call signs with hams in 100 countries in a weekend. In California, volunteers save lives as part of their involvement in an emergency communications net. And at the scene of a traffic accident on a Chicago freeway, a ham calls for help by using a pocket-sized hand-held radio.
```

There are, of course, hundreds of megabytes of ham radio information out there of every description, from text files to programs of interest to hams—all a point and a click away. Vendors of ham radio equipment and software, hams with information about using equipment and building things, all of it right there for *you*.

How Do I Get Connected?

As it happens, now is a great time to get connected to the Internet. The competition is fierce, and prices are *very* low. But, you must know what you are buying or you could be very disappointed.

Watch out for "fake" Internet access. What do I mean? What I described above comes from actually connecting *your computer* to the Internet. In other words, through software and an ISP's "router" you place your own machine on the Internet as a peer (an equal to all the other computers on the net.)

When I say "fake," I mean that although you can access information that is on servers which are on the net, your connection is by dialing up someone else's machine and acting as a terminal. This is the nature of Internet connectivity offered by several large national on-line services. It is not what the true "netsurfer" wants.

"Real" Internet connectivity comes through a couple of protocols called SLIP and PPP. SLIP means Serial Link Internet Protocol, and PPP means Point-to-Point Protocol. They are functionally equivalent, with PPP being a bit more flexible. Either way, you'll be on the net.

What do I need?

The basic components of an Internet connection are a "stack" and the clients. The stack is the software that runs TCP/IP; included in this are the dialer and component that manages the SLIP or PPP connection. The most common stack in use today for SLIP is based on WinSock—the standard TCP/IP services component for Windows—but you don't need to worry about details, your ISP will do that for you.

"There are hundreds of megabytes of ham radio information out there of every description, from text files to programs of interest to hams—all a point and a click away."

The thing you need most is a reliable ISP. Soon (probably next issue) there will be a list published here of ISPs recommended by your fellow hams. Until then, use the repeater! Ask around and find out who is doing a good job in your area. Prices will be very competitive; you shouldn't have to pay more than about $20.00/month for unlimited (or practically unlimited) SLIP/PPP access at 28.8 Kb/s access. Contact an ISP, and they will get you going.

Modems are Important

I will leave you with this note: A good modem is critical. Today, 28.8 (V.34) modems are common, inexpensive, and expected. If you have anything less than 14.4 today, upgrade *before* you sign up for Internet service. If you have a 14.4 modem, seriously consider 28.8! I can happily recommend the USR Robotics Sportster V.34 modem as an excellent value. It is an inexpensive and high-quality, high-speed modem. Make sure you buy a V.34 modem, *not* a V.FC modem, which is an outdated "non-standard." Also, don't be disappointed if your 28.8 modem never connects faster than 24 Kb/s. This is normal, because phone lines aren't perfect.

So, after you begin your net surfing career, drop me a line at: n1ewo@iquest.net—I'll be glad to hear from you! 73 de N1EWO

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DRO Frequency Marker for 10 GHz From Salvaged C Band TVRO Converters

Here is a note of interest from John WA4WDL concerning the use of DROs (dielectric resonator oscillators) from defunct or discarded TVRO (television receive only) downconverters. These units are modified to provide a marker generator for the 10 GHz amateur band. Also, John provided a charge pump voltage doubler that he used to power these units from a 12-volt source. The application for this marker generator is to provide a stable frequency reference and to use this reference as a marker pinpointing a specific frequency in the wideband FM portion of the 10 GHz band, using it as a guidepost for all operations. Following are the conversion steps taken by John WA4WDL:

One of the first concerns when trying to operate on 10 GHz using wideband frequency modulation with modified intrusion alarm Gunn diode sources is determining what frequency you are on. Past remedies have centered around using a 2 meter HT feeding a diode-in-waveguide harmonic generator, which works like this: The HT is set to a frequency of 146 MHz and is used to transmit low power (100 to 250 mW), which is injected into a diode in a waveguide mount suitable for the microwave band of interest, in this case 10 GHz using WG-16. The diode is made to function as a frequency multiplier, multiplying the 2 meter RF into the 10 GHz band. The 70th harmonic times 146 MHz is exactly 10,220 MHz, a wideband FM primary frequency. Other 2 meter frequencies are possible but do not work out as exactly as in this example.

However, because of the relatively low frequency of the 2 meter rig and the lack of image rejection in the 10 GHz receiver, some confusion still exists in image frequencies and other harmonics of 146 MHz, also present. This method relies on you knowing what frequency you are on with an accuracy of plus or minus 50 MHz. If you have no clue where you are, a single pinpoint reference will remove uncertainty and provide you with one more idea on how to set frequency at 10 GHz with available surplus material.

Recently, while dissecting some C-band TVRO block downconverters, I discovered that the internal local DRO operates at approximately 5.150 GHz. Doubling this frequency with a diode-in-waveguide harmonic generator results in an output frequency of 10.3 GHz, which is conveniently in the 10 GHz amateur band. Don't let the quality of surplus block downconverters worry you. While the RF amplifier portion of the unit might be damaged or non functioning, the DRO circuitry needed for this conversion has rarely been inoperative. Almost all DROs still function well.

I have noticed that after doubling, all harmonics and the fundamental are at least 30 dB below the desired 10.3 GHz signal. The 10 GHz waveguide is an excellent beyond-cutoff attenuator for the fundamental, and the efficiency for tripling is very poor. Although DROs come in several configurations, two kinds are easy to use.

The first involves a block downconverter that was intended for use with a preamp (see Photo A). The RF input goes to a ring mixer which is also fed by the local oscillator. With some razor blade surgery the ring mixer is modified to let the local oscillator connect directly to the RF input connector. (See Figure 1 for details.)

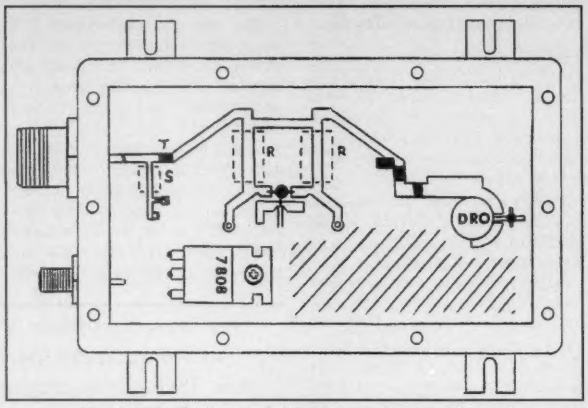

Figure 1. Modifications to downconverter printed circuit board.

The modifications to the ring mixer are marked "R." Some other modifications are necessary. DC power for the preamp is fed out the RF input connector. For my application this is undesirable because the 1N23 multiplier diode could be destroyed. Instead the DC insertion trace marked "S" is cut and carefully peeled up from the printed circuit board. The 1N23 point-contact diode multiplier requires a DC ground return. The local oscillator has a two resistor L-pad output attenuator which can be used for the DC return by simply replacing the chip capacitor at point "T" in the RF input line with a jumper made from copper foil.

The capacitor was originally used to block the output DC from reaching the mixer. Photo A shows both an unmodified and a modified downconverter. Each block downconverter has an internal 7808 three-terminal voltage regulator, which is retained. The units can be powered from 11 to 18 volts. DC power is applied directly to the IF output type "F" connector. Current drain can be reduced by cutting the appropriate printed circuit traces to circuitry that is not required. Output from the DRO is about 3/4 mW at 5.15 GHz, which is more than sufficient to drive a 1N23 diode harmonic generator.

The second block downconverter is with a packaged Murata DRO. (See Photo B.) Carefully unsolder and remove the oscillator unit, then mount and resolder it to a printed circuit board. Even though it is lossy at 5.15 GHz, ordinary G-10 1/16th-inch thick double-sided glass epoxy board material is used. It's workable and easily available. An SMA connector is used to couple the RF back from the printed circuit microstrip into a semi-rigid coax cable. (See Photo C.)

Typical RF output is between 3 and 5 milliwatts at 5.15 GHz. With 12 to 14 dB loss inherent in half-wave harmonic generators, I still get around 0.1 milliwatt output at 10.3 GHz—not bad at all. A complete unit with 1N23 diode harmonic generator is shown in Photo D.

This method does not require diode waveguide mounts without the bypass circuitry commonly found in simple diode mixer mounts. Nevertheless, the result is a no-tune, compact, reasonably stable marker or test source for the 10 GHz band.

In operation, the Murata DROs that John has encountered require 10 volts at 20 to 30 mA for power. It is always a good practice to power up the unmodified downconverter with 15-18 volts and measure the oscillator and

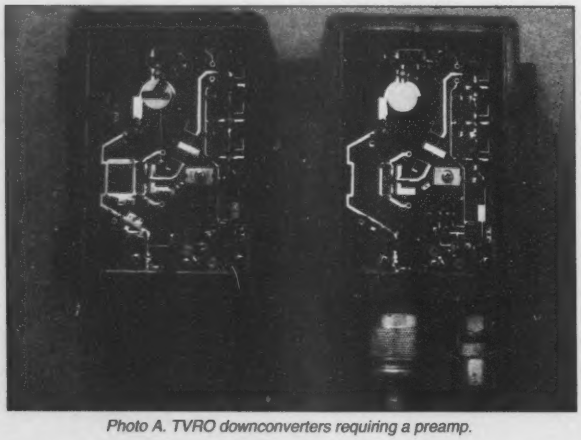

Photo A. TVRO downconverters requiring a preamp.

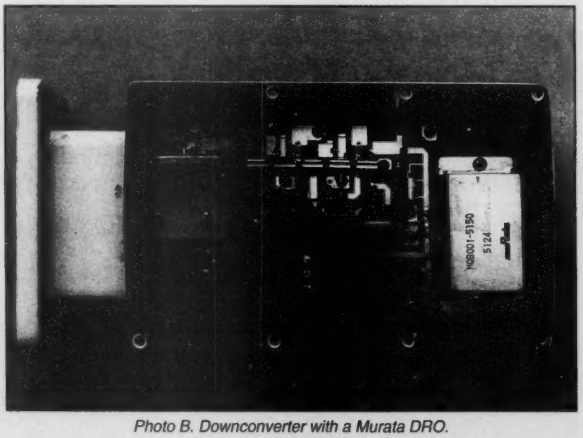

Photo B. Downconverter with a Murata DRO.

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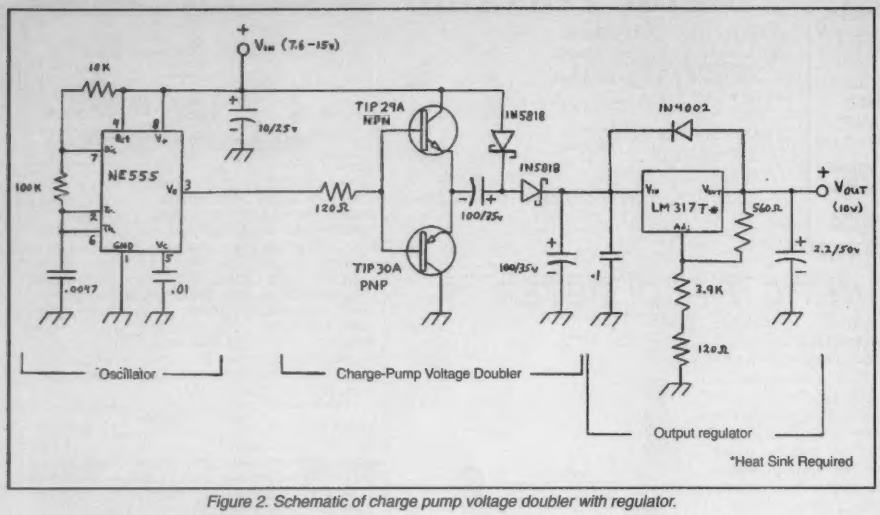

Figure 2. Schematic of charge pump voltage doubler with regulator.

the circuit supply voltages before beginning surgery. For field tests, better voltage headroom for the voltage regulator is desired. The difference between the required 10 volts and the output of a 12-volt dry cell battery is too small to use a common 7810 three-terminal voltage regulator removed from the downconverter, so a charge pump voltage doubler followed by a voltage regulator was selected for field applications. Figure 2 shows the schematic of the charge pump constructed.

The charge pump incorporates several small changes over previously published circuits. First, the NE-555 oscillator circuit was changed to produce a more nearly square wave output pulse duration. Second, the rectifier diodes were changed to Schottky rectifiers to reduce the voltage drop across the rectifiers. Schottky diodes have a lower voltage drop than conventional rectifier diodes; i.e., a 1N400X-type diode will exhibit a 0.7-volt drop when in conduction. A Schottky rectifier will exhibit about 0.4 volts in the same application. Last, the usual 240-ohm resistor used in most LM-317 adjustable voltage regulator circuits was increased to 560 ohms to reduce regulator current drain and increase battery life. Figure 3 shows the output voltage of the doubler before the regulator for input voltages up to 15 volts with no load and with the regulator and DRO connected. With no load and a supply voltage of 15 volts, the output from the doubler can reach 29 volts; therefore the output capacitor should be rated for at least 35 volts. Photo E shows one of the voltage doublers mounted in a small shield box. The voltage regulator is mounted in close proximity to the DRO.

For some units the LM317 was replaced with a 7810 regulator salvaged from TVRO converters. Using the doubler with this regulator allowed operation with dry battery packs down to 7.8 volts, which is well beyond the useful life of a 12-volt dry cell battery. Even 9-volt dry cell batteries could be used. The main penalty in using this circuit is the increased current drain. When given the choice between increased current drain and no operation, I'll pick current drain every time.

I have to thank John for one more excellent idea for converting surplus material into useful microwave test generators. For comments, contact John M. Franke, 23 Parkwood Dr., Apt 201, Yorktown, VA 23693-4819. Thanks again, John, for an excellent conversion project.

"When given the choice between increased current drain and no operation, I'll pick current drain every time."

Technical Note Update

Our microwave group just ran into a microwave transistor phenomenon that took us by surprise. It happened with a 1296 MHz block amplifier module that was built to spec, as far as we were concerned. It was supposed to put out 10 watts of power with a trickle of RF driving it. The problem was that the unit just did not perform at all, and power output was a small fraction of what it was supposed to be. After consulting with fellow wizards and the manufacturer's tech rep, we determined that the possible trouble was that we applied *heat sink compound* to the heat sink and RF device. As we all know, heat sink compound is used to improve heat transfer to the heat sink from the power or RF device.

We were informed that most microwave devices operating at 1000 MHz and above require such good ground that heat sink compound was not conductive enough for these microwave frequencies. We did not really believe this, but removed the grease anyway. When we tested the amplifier module without H/S compound, the module produced 10 watts of power with no other changes or modifications. Heat sink compound was the culprit. We had used the standard white silicon heat sink compound, which from now on I will classify as white heat sink *grease* suitable only for low frequency work.

There are several products that are made for UHF to microwave operation as heat sink compounds. These materials usually resemble an epoxy with very high silver or other metallic additive making the thermal properties very conductive. I haven't been able to obtain any of these materials for evaluation, but have observed some power FETs attached with this type of material. I had not fully appreciated the RF-conductive material before, but close examination of many different heat sinks removed from commercial devices showed most were using this RF-conductive heat sink thermal compound.

We had experienced a similar example when we tried to test a 10 GHz Qualcomm transmitter module by soldering the gold-plated transistor's heat sink to the rear copper ground foil for a quick test. This test proved to be flawed and the transmitter, which is rated at 1 W output, would not produce any significant output power at all. When we ran our finger near the

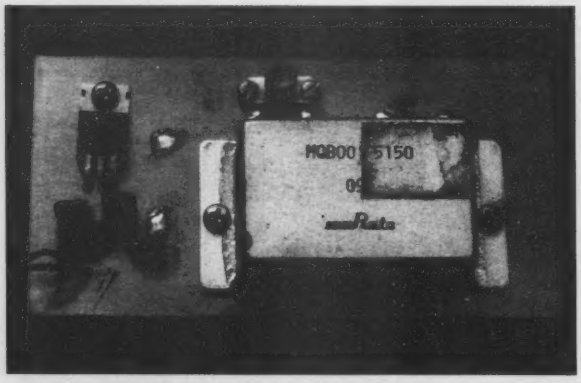

Photo C. Murata DRO remounted on a circuit board.

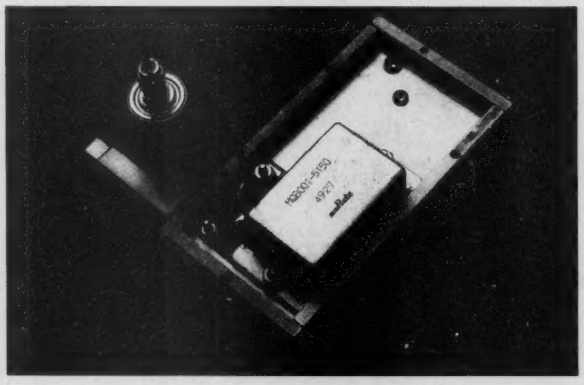

Photo D. Complete 10 GHz marker generator.

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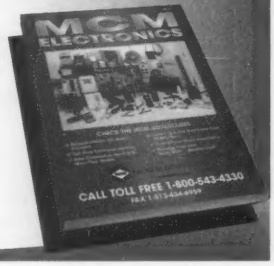

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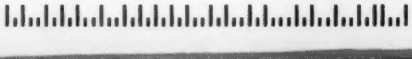

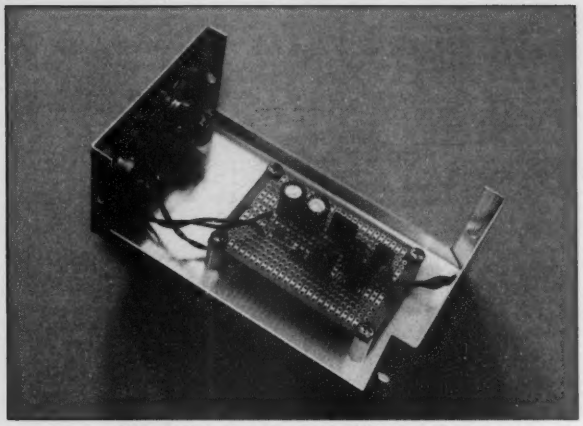

Photo E. Voltage doubler mounted in shielded box.

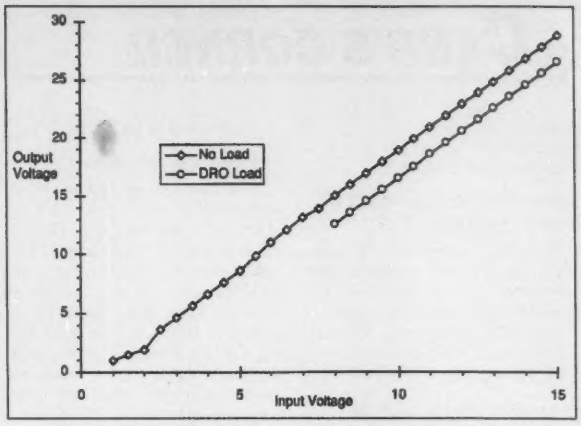

Figure 3. Charge pump doubler output for input voltages of 1-15 volts.

grounded side of the PC board under one of the transistor stages (soldered to ground), power output improved several dB, a very unusual increase in RF power. To get the transmitter back in operation, we had to remove the solder grounding all the transistors and screw the devices directly to an aluminum heat sink along with the PC board ground's common ground foil. Then the transmitter strip functioned normally, and shortly we were able to obtain the full 1-watt output power.

These two examples show the extreme importance of proper grounding in microwave devices. I would not have believed either of these two examples, and thought that in each case it was well within a small fudge factor acceptable to good construction techniques. However, both methods proved that the silicon heat sink grease we used gave very poor results. There might be similar material out there, but I'll report on that when such materials become available. Till then, if you experience weird results, question your heat sink compound and, hopefully, removing it will avoid some quite perplexing head-scratching.

Well, that's it for this month. Currently we are putting together a complete 10 GHz transceiver driven by synthesizer control (*73* magazine, June & July, 1994). So far, the circuitry for the transceiver is converting well from a miniature PC board for 14 GHz to 10 GHz operation. For surplus, check out your local cellular distributor for old, large 850 MHz cell telephones. They're a drug on the market, often in broken condition, or just large units which are priced very cheap or given away. Look into them for possible circuitry for the 900 MHz band.

In the cell phone I picked up for $4.00, I have a complete RF receive front end and two VCOs, one for 800 MHz and one for 900 MHz. These parts can be used on their own or an attempt can be made to convert portions of the cell phone. Check out this surplus opportunity locally.

As always, I will be glad to answer questions regarding this and other related amateur topics. For a prompt reply, please send a SASE. 73 Chuck WB6IGP

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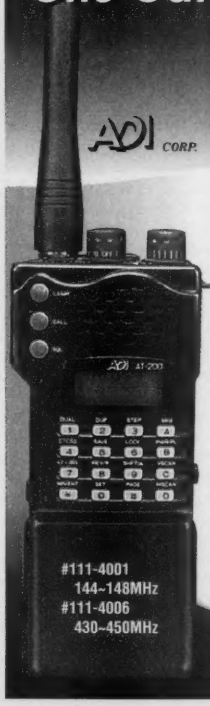

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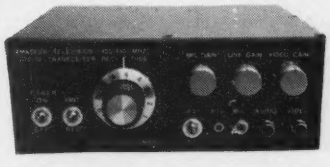

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Some Miscellania About DC Power Supplies

Every few months I dip into the mail bag and try to answer some questions from readers. A fair amount of mail arrives, and I try to answer as much of it as possible. Unfortunately, that's not always possible, so please forgive me if you wrote and didn't get a response.

Voltage-Regulated Low-Voltage DC Power Supplies

Although most of my mail tends towards RF circuits, antennas, and the like, a substantial number of people over the last year or so have asked questions about low-voltage DC power supplies. I suspect the reason for this interest is that ham shacks and SWL listening posts today have a lot of store-bought and home-brew projects (yes, hams still build . . . the naysayers notwithstanding), gadgets, accessories, and assorted do-dads that all run on low-voltage, low-current DC power supplies. Furthermore, many (maybe most) of those items want to see regulated DC power, rather than simply rectified and filtered power.

The type of DC power supplies that are needed are typically 3 to 28 volts DC, with most of them being 5 VDC, 6 VDC, 9 VDC or 12 VDC. Current ratings range from 100 mA to 1000 mA (1 A), with only a few being higher (some 5-VDC circuits with a lot of older style TTL digital ICs might want to see 3 to 5 amperes of current, and some 12-VDC units intended for in-the-shack operation of small 2 meter or higher handhelds or mobile rigs want to see similar current ratings). For the most part, however, we need 1000-mA or less DC supplies for add-on outboard do-dads; this discussion is limited to that range.

Rectifiers and Transformers

The raw AC power right off the line isn't useful for electronic circuits, no matter what the voltage is. The DC power supply will use a transformer to reduce the voltage to the range needed by the circuit, and then a rectifier to convert the bidirectional "sorta-sinewave" AC to pulsating DC. When filtered, this pulsating DC makes a reasonable version of DC electrical power and can be used for many electronic circuits.

Two forms of rectifier circuit are shown in Figure 1. The circuit in Figure 1A is the classical full-wave rectifier. It requires a transformer with a center-tapped secondary winding. The center tap is connected to the chassis ground (or common line when no chassis ground is used), and is the zero-volts reference point. The outer ends of the winding ("A" and "B") are connected to the anode ends of the rectifier diodes (D1 and D2). The cathode ends of the rectifier diodes are connected to the load (represented by resistor R1).

The rectifier diodes have two ratings: forward current and peak inverse voltage (PIV). The forward current rating must be at least the same as the maximum output current of the power supply, and a 20- to 40-percent overrating would be a nice safety factor. The peak inverse voltage rating should be at least 2.83 times the RMS value of the secondary winding voltage (i.e., the voltage from the center tap to either end). For most low-voltage applications, using a 100-volt PIV (or higher) rectifier diode will suffice. Most people just go ahead and use the 1,000-volt PIV units, such as the 1N4007.

A filter capacitor C1 is used to smooth out the voltage pulsations of the rectifier output. A good rule of thumb is to use about 3,000 µF/ampere for unregulated DC power supplies. The actual value depends on the ripple factor desired, but the rule of thumb serves for most people's needs.

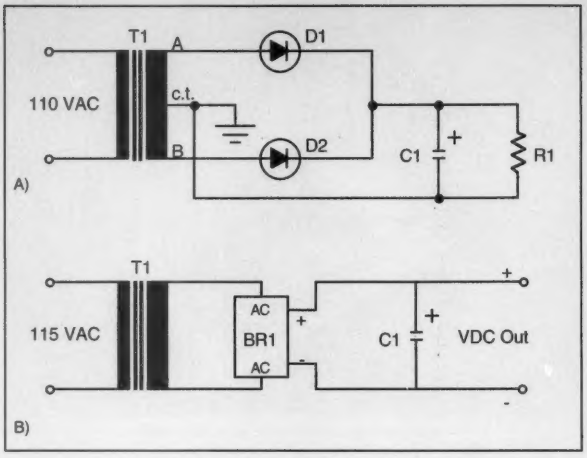

Figure 1. A) Classical rectifier circuit; B) bridge rectifier.

The rectifier in Figure 1B uses a full-wave bridge stack (BR1). Although you can make a bridge rectifier with four single diodes (e.g., 1N4007), bridge stacks are easily available in a number of different package styles. The AC inputs will be marked with the letters "AC" or the sine symbol "~." The positive output is marked with a "+" symbol, and the negative with the "-" symbol. One common form of package that is popular today is the DIP package that looks like a four-pin DIP integrated circuit package and fits onto 0.100 x 0.100 perforated wiring board.

The transformer does not use a center tap, because the common terminal is established by the bridge network inside BR1. A center-tapped transformer can be used, but some caution is needed. The current rating of the transformer is based on the classical full-wave circuit shown in Figure 1A, and not the bridge rectifier in Figure 1B. If a bridge circuit is used, then the transformer may have to be derated by one-half. In other words, if you need a 1-ampere power supply, then a 2-ampere center-tapped transformer is needed. If the transformer is intended for bridge service (and has no center tap), then a 1-ampere transformer would be needed. You can often get away with not derating, but only for short duty cycle operation. You may literally be "playing with fire" if you run the transformer too close to its apparent maximum rating.

Voltage Regulators

Most projects today need regulated DC power. These circuits keep the output voltage stable despite changes in load current demand or changes in the applied AC voltage. Normal power line voltage fluctuates from 105 to 125 volts RMS quite normally, and during summer "brown-out" conditions it might droop below 100 volts RMS. This is a 9- to 10-percent fluctuation (some experts say that 15-percent fluctuations are not as rare as you might think).

Another advantage of the voltage regulator is that it reduces the ripple considerably. I recall a salesman who came by a shop I worked in (early 1960s) and told us he had a DC power supply that would power CB radios and car radios, and had "the equivalent of one farad of ripple filtering." What he was telling us was that Delco Electronics had used electronic voltage regulation in their P-612 power supply, and the voltage regulator smashed the ripple down as much as a 1,000,000 µF filter capacitor! That power supply was a "first" for us, but today such power supplies are commonplace.

Fortunately, today we can buy three-terminal IC voltage regulators that provide a fixed (standard) voltage, and have current ratings of 100 mA, 750 mA or 1,000 mA, depending on the type. Figure 2 shows a typical circuit using these regulator devices (U1

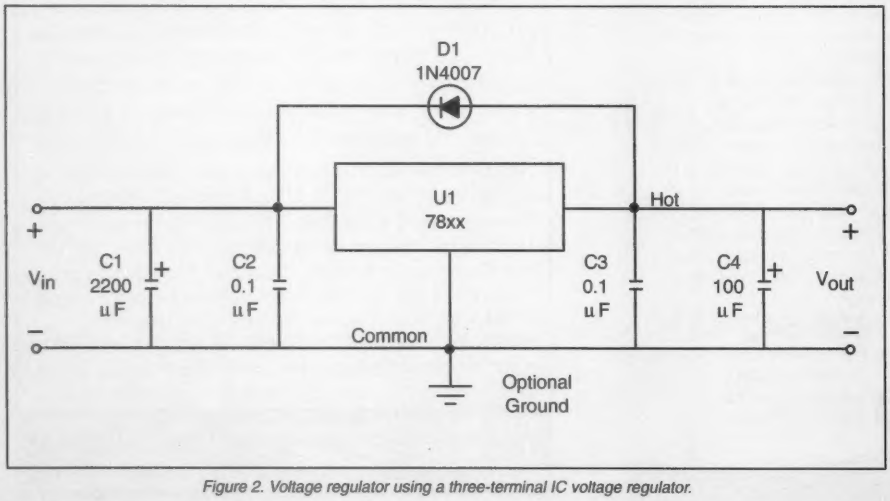

Figure 2. Voltage regulator using a three-terminal IC voltage regulator.

is the regulator).

Two different types of part number are seen on the regulators. If the device is of the LM-340 series, then the form of the type number is "LM-340n-xx." The "xx" indicates the voltage rating. If it is "05" or "5," then the device is a 5 VDC unit; if xx is "12," it is a 12-volt regulator. The "n" may or may not be seen, and indicates the package type (which also tells us the current rating). A "K" indicates a TO-3 diamond-shaped power transistor style of package, while a "T" indicates the TO-220 plastic package device. Thus, an "LM-340K-12" is a 12-volt regulator with a TO-3 package (which means that it is probably a 1-ampere device). TO-220 devices are typically rated conservatively at 750 mA in free air, or 1,000 mA if heat-sinked.

Regulators of this type with negative output voltage are marked "LM-320n-xx." There are pin-out differences between the LM-320 and LM-340 devices, so look it up before using the regulator.

The alternate marking scheme is "78xx," in which the "xx" indicates the voltage output rating. The 7805, therefore, is a 5 VDC device, and the 7812 is a 12-volt device. The negative output voltage versions are "79xx" (and again, pin-out differences exist).

Small packages, such as the TO-92 plastic transistor package, are rated at 100 mA. These devices are often marked with type numbers that have an "L" (for "low power") in the part number. Thus, a "78L05" is a 5 VDC output regulator with a TO-92 plastic package and a 100-mA current rating.

Capacitors C2 and C3 are used to keep noise from affecting the operation of the voltage regulator. These 0.1- to 0.47-µF capacitors are to be mounted as close to the body of the regulator (U1) as physically possible.

Capacitor C1 is the ripple filter, and should have a minimum value of 1,000 µF/ampere (some say 2,000 µF/ampere). For the typical 1-ampere power supply, I prefer to use a 2,000 µF/50 WVDC unit. Note that C1 is marked with polarity. These capacitors must be installed correctly, or may blow up!

The output capacitor C4 is used to smooth variations caused by sudden shifts in load current. It has a rating of 100 µF/ampere. If C4 is used, then diode D1 should also be used. This diode is reverse biased during operation, but when the power is turned off it will become forward biased any time the voltage across C4 is greater than the voltage across C1. This keeps the charge in C4 from damaging the substrate layer inside U1.

Next Month . . .

Next month, we will finish this topic, and look at a variable output voltage regulator and some switching schemes for DC power supplies. 73

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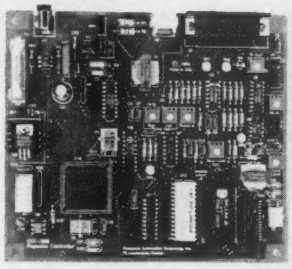

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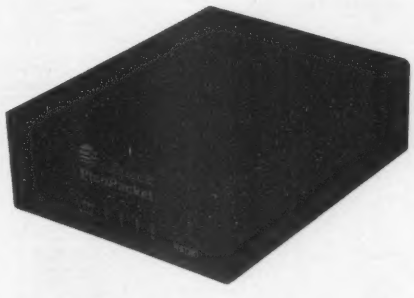

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LISATS

There is a very active ATV group near the Kennedy Space Center called LISATS (Launch Information Service & Amateur Television System, Inc.). Due to their close proximity to the space center, the LISATS group wanted their ATV repeater (with the very appropriate callsign K4ATV) to feature continuous coverage of the NASA Select video feed during each Space Shuttle mission. Located at a commercial radio station's studio site (WLRQ) in Cocoa, Florida, the K4ATV repeater operates with an input on 434.00 MHz and an output on 421.25 MHz.

There are around two dozen ATV stations in the area that can access the ATV repeater. Since the output can be tuned in via a cable-ready VCR or TV (cable channel 57), the LISATS group has a wide audience throughout central Brevard County. Since their antenna is located at the 235-foot level of the WLRQ tower, the K4ATV machine can be seen over 30 miles away under normal conditions. A number of schools have receivers in their classrooms that can tune in the Space Shuttle coverage. The LISATS group also provides the NASA Public Affairs Office with handouts and information about their system that is given to the press during every Shuttle mission. Since the repeater is near the Shuttle launch area, a snow-free picture can be tuned in with a small portable TV for those observing the launch from the various launch viewing areas. It's great to see live NASA coverage while actually watching the Shuttle take off.

The K4ATV Repeater

The receive antenna is a Hustler 10 dBd vertical collinear located 400 feet up on the tower (see Figure 1 for a diagram of the K4ATV LISATS system). After going through a VSB filter, the video and audio are demodulated with a P.C. Electronics ATVR-4 receiver. All video and audio switching and ID timing are controlled by a Micro Computer Concepts VS-100 ATV repeater controller. Using DTMF tones on either 70 cm or 2 meter FM, this controller can switch up to 10 video and 4 audio sources. Currently, the repeater can be controlled to retransmit the received video from 434.00 MHz, NASA Select (as received by a Panasonic 1000 TVRO system), the LISATS logo (VDG-1 video identifier) or a computer-controlled bulletin board system. The bulletin board screens come from the output of a Commodore 64 running the Engineering Consulting Video Poster™. A non-volatile RAM cartridge can be loaded with up to 26 scrolling (or flashing) messages that sequence announcements of current amateur radio news and information, including a daily updated list of planned NASA launches and color test patterns on-screen via the repeater. The messages can be uploaded easily from one of the control operators from their homes (K4RBD or N4KCI) via a 1200 bps telephone modem. In addition, they plan to install a tower camera to aid in Skywarn observations.

The transmitter system consists of an ATV Electronics 5-watt exciter driving a D-100ATVR repeater amplifier. After passing through an International Crystal VSB filter (ICM-407), the signal is fed up 7/8" hardline to a 10 dBd gain Sinclair vertical collinear at 235 feet. The LISATS system in its current configuration was assembled by John Anderson K4GCC, Ernie Baldini K4RBD, Bud Checkett WØTPB and Dave Glenn KD4SFR with much financial support from Gordon Seaward KA4FFA.

Tune into the Action

If you are in the central Brevard County area and would like to tune in the activity, you can see the repeater ID for 20 seconds on 421.25 MHz (cable-ready channel 57) every 10 minutes. In addition, the repeater retransmits NASA Select continuously during each mission. Recently, the FCC and NASA have authorized retransmission of other published expendable vehicle launches, so you may not have to wait for a Shuttle flight to tune in the action on the LISATS repeater.

There is a weekly activity night every Wednesday evening at 19:45 (7:45 p.m.) ET. Although the usual ATV talk-frequency is 144.34 MHz, during the activity night the group uses the K4GCC 146.94 (-600) repeater, famous for countdown coverage all over the Cape area. This machine is a great place to meet the locals just about any time during the rest of the week as well. You never know who might show up on this machine. One night Ernie K4RBD started up a conversation with WA4SIR. It turned out to be Mission Specialist Ron Parise, who had a quick chance to make a

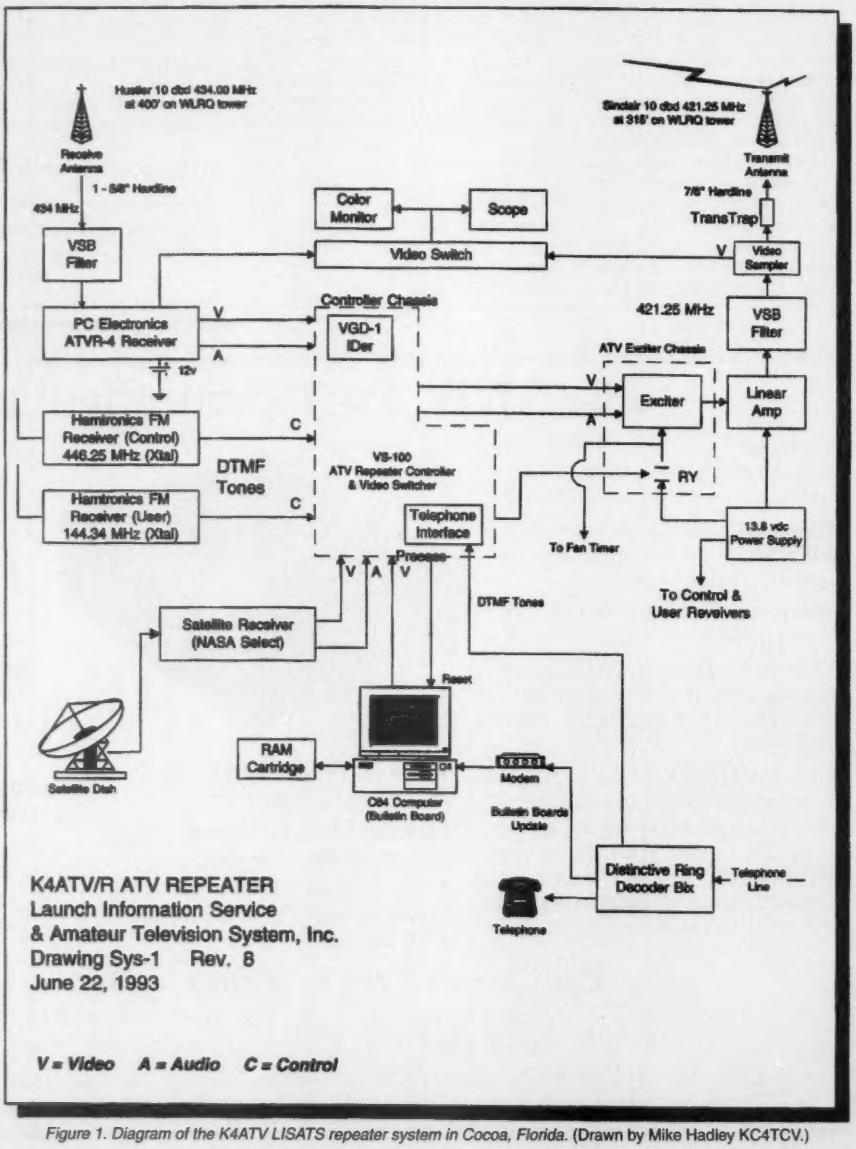

Figure 1. Diagram of the K4ATV LISATS repeater system in Cocoa, Florida. (Drawn by Mike Hadley KC4TCV.)

QSO just before he suited up to head out to the launch pad!

In addition to NASA coverage, the Brevard County EOC (Emergency Operations Center in Rockledge, Florida) has an ATV station that can be used through the repeater. The LISATS group has also successfully demonstrated the usefulness of ATV for emergency preparedness. They have the LISATS group (members receive a very informative newsletter), you can write to: Ernest Baldini, 453 Watts Way, Cocoa Beach FL 32931. Ernie's E-mail address is ebaldini@ddi.digital.net or ernestb1@aol.com.

For those of you on the World Wide Web on the Internet, you can browse through the LISATS information page. To access this screen, log on to www.digital.net. Once in the Florida On-line home page, look under Local Ham Radio clubs and then click on the entry that reads Launch Information Service & Amateur Television System, Inc. *Thanks to Ernie K4RBD for the above information.*

"It turned out to be Mission Specialist Ron Parise, who had a quick chance to make a QSO just before he suited up to head out to the launch pad!"

participated in Red Cross simulated disaster drills, with several of the members transmitting pictures from mobile stations back to the command center. Another project in the works is a backpack 1200 MHz ATV unit.

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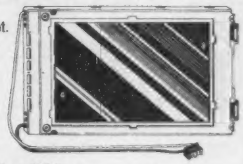

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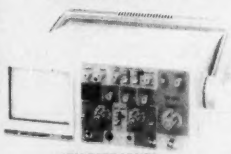

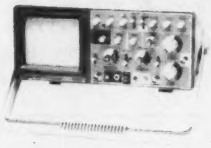

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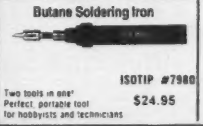

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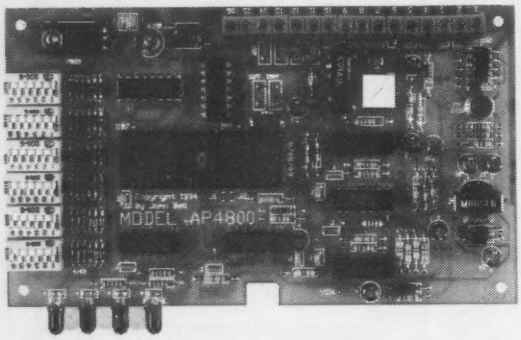

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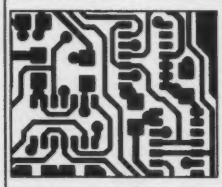

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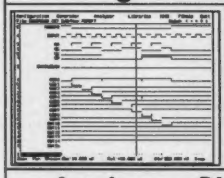

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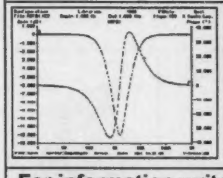

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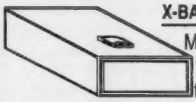

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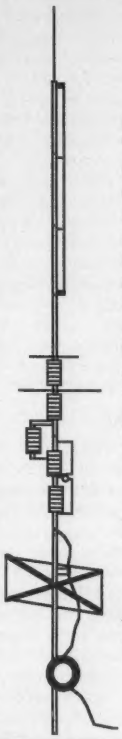

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RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Baltimore MD 21200

By all accounts, one of the most popular versions of this column is the one which you all help write. The questions you all pose are often the launching sites for some of the more fascinating topics covered in "RTTY Loop." So, to start off the nineteenth year of this column, let's turn to the mailbag.

Glenn Inman VE6INM of Sherwood Park, AB, Canada, sends along a question as to whether or not I am aware of a scheme to use the Radio Shack Color Computer for packet or RTTY without any TNC. He would like to dedicate a unit to just these modes. With three CoCos kicking around, Glenn thought he may be able to use software rather than buy a multimode TNC. Well, I did look into the packet question a few years back, and was rather disappointed. It seems that while the 6809 CPU of the Color Computer is not unable to do the work, the CoCo itself may well not be up to the task. However, RTTY is a different story.

Several years ago, a routine was published here in "RTTY Loop" that can accomplish RTTY sending and receiving with only a simple interface for the audio-to-digital conversion. The quickest way to obtain the software is on the CoCo SIG on Delphi. Search the telecommunications library for "RTTY," and you will see several programs for RTTY on the CoCo. Good luck, and let me hear from you. Vern Modeland WAØJOG drops a CompuServe E-mail relating that:

Simple Programs Plus Hardware

"As an old broadcast newsman who started more than 4,000 days harvesting and devouring the output of a bank of teletypes, I've reluctantly had to give away my Model 15, then turn down the gift of a complete Model 15 Send-Receive setup with reperf, due to lack of space in retirement. It leaves me with only this Tandy 1000 TL/2 with 2-meg hard drive, and my HF and VHF Kenwoods with which to transition into RTTY in the computer age. I've read the ads closely, learning not enough, and articles, but still have questions. And there is no one close to this location on whom I can count for technical counsel as to the available programs, or programs-plus-hardware, that'll put me back on RTTY simply and without a lot of unnecessarily expensive bells and whistles. I'd welcome any thoughts, suggestions, or direction you might offer."

Well, Vern, you have two ways to go. If you want to play around with a solution low on cost but a bit more time intensive, you can try some of the programs that will run RTTY and other digital modes on a computer without a hardware terminal unit. A look at the programs in the "RTTY Loop" Software Collection will turn up many such programs. Alternatively, you can use the computer just as a terminal, and count on a hardware terminal unit to do the hard work. While this may cost a tad more up front, you may be rewarded with a quicker path onto the air, and a flexible on-the-air setup.

Whichever way you choose, you have the nucleus of a capable digital station. Let me hear from you with the story of your next steps.

A problem of a different sort is presented by Wayne WB4OGM. He is looking for sources for information on suppressing computer-generated RFI for HF radios. He was working on getting back into RTTY and was trying to quiet a PC XT with mono monitor using a HAL ST-6 TU. He had the PC pretty quiet, but the monitor generates a lot of noise, apparently through its cabinet, because chokes on the power and data cables didn't seem to help.

Well, Wayne, I agree that the plastic cabinets of earlier monitors present a problem. Other than switching to a more modern monitor, one which limits external emissions, I have no good way to eliminate RFI from such devices. Putting chokes on all external leads is usually helpful, but sometimes even they won't help.

Larry Antonuk WB9RRT of Marlborough, NH, writes:

HAL

"I'm a now-and-again RTTY fan, with my PK-232, but my biggest fault was getting a fellow ham hooked. The problem is, he keeps asking me all these questions, as if I know what I'm talking about. He's been using an MFJ-1224 with a CoCo and is happy with it. Unfortunately, at the last hamfest he bought a HAL ST-5000 ($50). Once he brought it over and we checked it out and found out it was only a demodulator, he was less than thrilled. However, the great name of 'HAL' still made us press on. At present, we know that (1) it's just the demodulator; (2) it only puts out 20 mA loop signals, not TTL or RS-232 levels; and (3) I have a 20 mA to RS-232 converter from something else he could use, but this would still give us Baudot, rather than ASCII, to his IBM PC. We would like to get the HAL going on his PC, but maybe for the wrong reasons . . . .

QUESTION 1. "Is the HAL going to be a better performer than the 1224? This was our initial thought, until we realized that the HAL was ten years older than the MFJ. Neither schematic looks that much more intense in the audio filtering circuits, etc. Should we just put the HAL on the rig for looks, and use the 1224 instead?

QUESTION 2. "If we should pursue the HAL, do you know of any Baudot to ASCII gizmos or programs that are appropriate? I have access to any of your articles over at Peterborough (and in the basement) if any come to mind.

QUESTION 3. "Can you recommend a good PC-based RTTY program? I currently use Procomm, which is a pain. The macros are too small, the chat mode won't work with my PK-232, etc., etc. Cheap is good, free is even better! Probably the listing of programs, etc., you mention would be a good start. Thanks for your help, and for all your columns over the years. (I know you sure can't be doing it for the money!)"

Now here is a set of questions I can sink my teeth into! First off, please don't be disappointed that the ST-5000 is "only" a demodulator. Such a demodulator did quite well for many years of hams until the current crop of smart boxes hit the scene. As I mentioned above, I am not aware of packet software for the CoCo, but the RTTY software mentioned above should work just fine with the CoCo and ST-5000. Alternatively, using the ST-5000 with a PC and several of the software packages in the "RTTY Loop" Software Collection should work just fine. Procomm is just an ASCII-type communications program, not a RTTY or packet program. Check out software written for amateur applications. I think you will be a bit happier. Well, having mentioned the "RTTY Loop" Software Collection a few times, you all can presume it remains available, now numbering more than ten disks. Send me a self-addressed, stamped envelope, or a piece of E-mail on any of the services below, for details. Comments, questions, or suggestions are welcome as well; send them to me at the above address by "snail mail," or electronically on CompuServe at 75036,2501, Delphi at MarcWA3AJR, America Online at MarcWA3AJR, or via Internet at MarcWA3AJR@aol.com. 73

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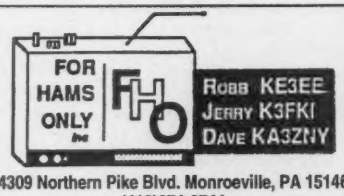

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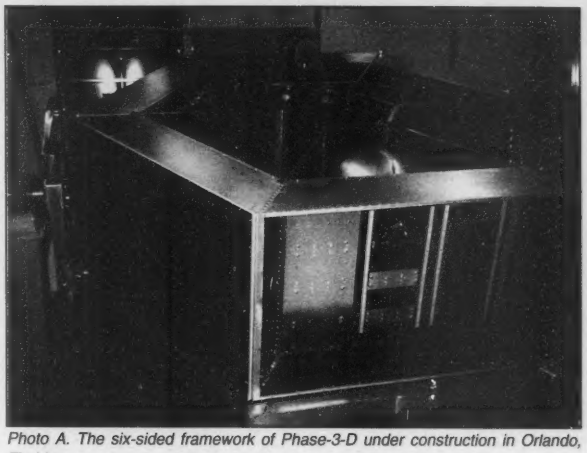

Photo A. The six-sided framework of Phase-3-D under construction in Orlando, Florida.

Then

When I first saw the cover of the August 1973 issue of *QST*, I didn't give it a second thought. Some guy was pouring something out of a paper cup into what looked like a circuit board in a wooden box. I was more interested in the construction articles and the advertisements. Later, when I had finished putting a parts list together for the QRP transceiver, and had thoroughly investigated the articles on the new Hallicrafters and Heath rigs, I went back for another look. The cover caption read, "W3ZKI is shown 'potting' the OSCAR 6 repeater prior to launch." Questions came to mind. What kind of repeater needs to be potted? What was an "OSCAR?" How would it be launched? If this was some kind of equipment to be sent into space, why wasn't it being done by white-coat technicians in a clean room in a large government or industrial installation? I was about to get my first introduction to the amateur-radio satellites. The article assumed I was already up to speed with ham satellites. Part one of "The Sixth Amateur Satellite—A Technical Report" had apparently come out in July. Photos, block diagrams, schematics, drawings and a lot of text, put together by Jan King W3GEY, brought this curious self-contained, repeater-in-the-sky into perspective. Amidst the technical jargon that might look more at home in technical journals, were captivating bits of information that gave the reader a sense of "home-brew" and "built in the garage." In addition to the fact that wooden molds were used to contain the various circuits and potting compound, the 10 meter dipole for the downlink signals ". . . was constructed from standard 1/2" measuring tape . . ." Donations of parts and services for the satellite came from many well-known sources, including NASA, RCA, J. W. Miller, National Semiconductor, and others, but the builders were hams. Armed with a defined goal, well organized plans, and resources, components of OSCAR-6 were built by skilled enthusiasts all around the country. It worked. The satellite was expected to last a year after launch, but it didn't. It gave several years of service, thanks to the passionate efforts of the designers, builders, and those that monitored the satellite's vital signs and controlled it during its life in orbit.

Now

Times have changed. Thanks to the efforts of those that put together the hamsats of the past, the current major project, Phase-3-D, is a marvel of radio and computer devices big enough to carry many iterations of OSCAR-6 as small subassemblies mounted around the periphery of the seven-foot diameter spaceframe. When I visited the AMSAT construction facility in Orlando, Florida, I had to wear a white coat and white shoe covers when entering the clean room. Phase-3-D is big, really big. The computers and radio gear are only a part of the spacecraft. It has its own rocket motor and propellant tanks to boost it to the final elliptical orbit after the Ariane 5 vehicle takes the satellite to a transfer orbit. Banks of solar panels give the satellite a wingspan of over twenty feet and will provide power for many years to keep the onboard systems running. Antennas covering many VHF, UHF, and microwave ham bands will literally bristle from the structure. Phase-3-D has a commonality with its predecessors. The components and the work to put it all together come from the efforts of hams. Assemblies for the satellite are being built in university labs, industrial facilities, ham shacks of various satellite builders, and even garages.

The Houston Connection

Prior to his retirement from NASA, Lou McFadin W5DID, Principal Investigator for SAREX (the Shuttle Amateur Radio Experiment) volunteered to fabricate various parts for Phase-3-D under the direction of AMSAT Vice President of Engineering, Dick Jansson WD4FAB. Lou converted metric dimensions on drawings to English units and got several small, curious, aluminum spacecraft pieces built. The pieces were then "alodined" on a workbench in the driveway at Lou's house. Lou also offered to wind the magnetorquer coils for Phase-3-D. Photo A shows the space frame in the Orlando clean room. The coils will be mounted around the six-sided circumference of the top and bottom faces. The coils are then connected to the onboard computer responsible for spacecraft orientation. In order to keep the solar panels perpendicular to the light from the sun, and the antennas aimed at the earth, the alignment of the satellite must be actively controlled. Pulsing a current through the coils in a specific sequence, when the satellite is at its closest approach to earth, provides a calculated directional twist or torque against the earth's magnetic field. This rotates the spacecraft to achieve the desired orientation. Photo B shows the location of the twelve magnetorquer coils on a working model in the Orlando lab. Applying power makes the model twist and rotate when suspended and allowed to interact with the earth's magnetic field. The flight coils for the satellite consist of 6,000 turns of special enamel-coated copper wire over an insulating tape layer on iron rods. Each coil has two sections of windings separated by a machined insulator at the center. Three layers of 1,000 turns each are carefully wound on each side of the insulator. To wind the coils, several items were required, including a tape spooler, a take-up system to turn and support the rod, a turns counter, a feed system with a constant-tension brake, and heat lamps to cure the epoxy coating on the finished coils. While Lou provided many items from his garage, members of the South Texas Balloon Launch Team put together an electronic turns counter and motor speed control for the take-up system. Other hams from the Clear Lake Amateur Radio Club and the Johnson Space Center Amateur Radio Club got involved with the tedious winding process and the epoxy-coating operation. The coil-winding project took about two months and was reminiscent of the scene from the cover of *QST* twenty-two years ago. Sophisticated pieces of space hardware were being built by hams to tight tolerances and precise specifications in somewhat questionable surroundings. The finished coils were packaged and sent to the AMSAT lab for final assembly. Lou W5DID has accepted the job of Phase-3-D Integration Facility Manager. Most of his "retirement" is now spent working on Phase-3-D, bringing together the pieces from groups around the world. Launch is expected next year, but there is a lot left to do. The AMSAT lab in Orlando will be open for tours during the 1995 AMSAT Space Symposium and General Meeting in October. The event will be held at the Airport Holiday Inn. Keep an eye out for the magnetorquer rods in Phase-3-D when you are at the lab, but don't expect to see "Made in Texas" etched on them. It wasn't in the specs. 73

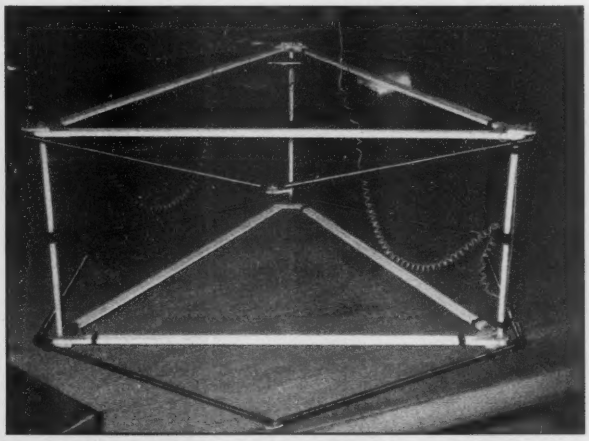

Photo B. A functional model of the magnetorqueing system for Phase-3-D.

Photo C. Lou McFadin W5DID and the tape spooler used to cover the iron torque rods prior to the coil-winding process.

ASK KABOOM

Your Tech Answer Man

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More Measuring Up

Last time, we were looking at the process of taking measurements in electronic circuits. Let's continue:

When we left off, we were looking at using an oscilloscope to measure the output of a power supply. Why do that when you can just hook a voltmeter up to the thing and be done with it? Well, it depends on what you need to know. Specifically, the scope will show you instantaneous changes in the supply's output that you just can't see with a meter.

Let's look at a plausible repair scenario. Let's say you have an older solid-state HF rig with an odd problem. This particular radio seems to basically work, but, when you transmit, the frequency pulls up and down a little bit on voice peaks, causing an FM effect that's distorting your voice and annoying other hams. So, you dig out the old meter and start probing away around the area of the VFO, which is an analog, non-synthesized one in this rig. After a few frustrating hours of fruitlessly going around in circles, you come to the altogether reasonable conclusion that the radio is possessed by demons. Or, perhaps, you're looking in the wrong place.

Steady As She Goes

Pursuing the latter possibility, what else could it be? You know a VFO needs a stable source of power, but you already put the meter on the B+ line and it showed approximately the voltage that should be there. So, no problem there, right? Whoa, wait a minute! Yes, the power supply may be giving you the right voltage, but does it stay there when the supply is stressed under the load of the transmitter? OK, you fire the rig up, into your dummy load of course, and check that voltage again, this time with your new digital voltmeter. It still looks all right, so it must be some other problem. If that's as far as you go, you're not going far enough, and you can just about count on another series of frustrating evenings at the bench. What you really need to know is what that voltage looks like at the instant your voice peaks come along. Does it wobble? If so, how much?

Zap, There It Is!

Now you get out your scope and take a look. You set the scope up to measure the 13 volts that should be there. It looks good, and, when you talk, it still looks good. Hmmm, wait a minute. To keep the 13 volts DC on the screen, you set the scope for DC coupling and 2 volts per division. Makes sense, but such a setup will make 200-mV wobbles look pretty darned tiny. In fact, you may not see them at all. Here's another way: set the scope for *AC* coupling and turn the sensitivity up to 100 mV per division. Now, the 13 volts will be blocked, and only the *changes* will show up. Son of a gun, there it is—voice peaks are causing a 200-mV change, all right. Is that OK? Maybe, maybe not. Most likely, it's not out of spec; even a well-regulated supply could be allowed to change that much as the load suddenly demands 20 amps of current. Still, we're on to something. The next thing to do is to check the VFO's internal regulator. Chances are, you'll find it shorted, or with an open zener diode, or otherwise unable to regulate the incoming changes in voltage, thus allowing the VFO's frequency to wobble along with the normal power supply variations. And, there's your answer. As you can see, the way you choose to use your measuring instruments can have a big effect on your success rate in fixing or building circuits.

Current

Can you measure current with a scope? Not directly. The only way to do it is to measure the voltage across a known resistance and calculate the current from there, using good ol' Ohm's Law. It sounds a lot harder than using a meter but, actually, that's how meters do it, too! The only difference is that now you have to do your own calculation.

The advantage of measuring current with a scope is the same one regarding voltage measurements: you can see what's going on in real time. Most of the time, you can infer what you need from voltage measurements and won't need to measure current with your scope. Now and then, though, especially in power amplifiers, it's very handy.

If the circuit under test has a handy resistor, such as a power amp's emitter resistor, you can simply measure the voltage across it and whip out the old calculator.

Pow!

Before you go actually hooking anything up, remember this very important fact: your scope's ground clip is actually connected to ground! So, if your circuit's ground is also really grounded, as many AC-operated circuits' grounds are (regardless of whether or not they have a third prong on the plug), you can't simply put the scope's ground anywhere you want, or you'll cause a short to ground and probably do some real damage. In that case, you're limited to measuring across something which has one end at ground anyway. More often than not, that's *not* going to be a point in the circuit which is useful to you. Probably the most useful current measurement is of power supply current feeding the circuit, and neither end of the B+ line is going directly to ground. The only way you can measure that with a scope is to uncouple either the scope or the circuit from ground. Is it worth all the trouble? Only if you really need to see the current in real time; otherwise, I'd just go with the battery-operated meter. By the way, always keep that limitation in mind when working on any line-operated equipment, especially switching power supplies and transformerless "hot-chassis" TVs. Remember, unless there's line isolation from a power transformer, the chassis could indeed be hot, or it could be very cold: at ground.

". . . keep in mind that your measuring instrument, be it analog or digital voltmeter, or scope, can and will rectify enough of a transmitter's RF to confuse itself. I've seen it happen with half a watt from an HT."

If you do need to provide your own resistor across which to measure, keep in mind its current limiting effects on the circuit you're testing. The added resistance will cut the voltage down some, and increased impedance in the power supply line may induce motorboating or other circuit instability. Now and then, you may have to add a capacitor across the circuit side of the resistor in order to undo the impedance effects. In any event, always try to keep the resistance value as low as possible in order to minimize disturbance to the circuit. What sets the minimum value for the resistor? The sensitivity of your measuring instrument and the voltages involved. Those, of course, are a consequence of the current being drawn through the resistor. The less current, the less resulting voltage, thus the harder it is to read it. Having a sensitive meter really helps.

Time And Distance

I've written before about RF grounds and their peculiarities. To summarize: because of the rapidly oscillating nature of RF and the finite time it takes for electrical energy to propagate, it is possible for a ground point to be out of phase with the circuit. In other words, it may not be at the same potential as other ground points, at any given moment, depending on how far away from them it lies. As the signal frequency goes up, the wavelength goes down, increasing this problem. At 450 MHz, lines a few inches long can become tuned circuits, with vastly differing voltages at either end, at different times in the signal's cycle. At 3.5 MHz, those same lines will appear at the same potential from end to end, because the wavelength is so long that there's almost no difference over such a small space.

So, it pays to select your measurement ground carefully. Always get it as close to the signal point as possible. If you clip the scope's ground to a point 8 inches away in a 450 MHz circuit, don't be surprised if your RF measurements mislead you.

Meter As Receiver

Finally, keep in mind that your measuring instrument, be it analog or digital voltmeter, or scope, can and will rectify enough of a transmitter's RF to confuse itself. I've seen it happen with half a watt from an HT. You need to measure a DC voltage during transmit, and you get a number that just doesn't make sense. Chances are, your transmitter's RF is the culprit. In fact, you can use most analog meters as simple field strength meters just by transmitting with the antenna a few inches away, with no connection at all. There's no easy way out of this, except to use a dummy load.

Well, we're near the end of our measurement topic, and next time I'll tie up a few loose ends and move on to something else. Before I go, though, I need to respond to a reader whose letter I just recently received. He said he'd been trying to reach me for a long time to ask about a reference I made awhile back regarding DSP audio filters. My apologies; I've moved several times and I suspect numerous pieces of mail have not managed to follow me around from city to city. At the time, I was referring to the JPS NIR-10, which was one of the first available DSP units. Now, there are many on the market. I haven't had the opportunity to play with them, so I can't offer any recommendations, except to say that digital signal processing makes for some awesome audio filters which are dramatically better than even the best analog filters, and can do things no other technology allows.

Until next time, 73 from KB1UM.

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Massillon OH 44646

Mikey's Big Adventure

Every now and then I get inspired and come up with an outstanding idea. Although I was inspired, this idea fell flat in the middle of the road. Let me explain.

I enjoy riding a bicycle. Although I've been less than active these last few years, I try to add up the miles when I can. In fact, I'm working at building up enough heart tissue to make the trip back and forth from work. I've been putting this off for two reasons. First, I'm lazy. Second, there are two "better call 911" hills (make that mountains) between here and there. So, to entice myself to get on the saddle and down the road, I decided I would add some ham radio to the bike.

QRP CW on a Mountain Bike!

I always carry an HT with me, so I can personally direct the ambulance to my location via the phone patch. But, I wanted more. Ah, yes! How about some QRP CW on forty meters as I huff and puff down the streets? I thought CW would be great, as the other guy would not be able to hear me wheezing and puffing as I peddled.

I started out by attaching a 40 meter loaded whip antenna to the rear sprocket holder on the bike. Mounting this antenna so it would not fall off required a lot of planning. Bicycles are not known for a smooth ride; I used a vise grip.

Now, this antenna measures about eight feet tall when fully assembled. Here was my first problem. How do you get your leg up and over an antenna that high? Well you don't. I had to get my fat butt on the bike by pulling my leg up over the handbars from the wrong side of the bike. I really don't know if there is a wrong side to a bike, but let's just say it's backward from what I'm used to doing. Talk about stretch marks!

Another problem came up with the antenna and its mount. The SWR was way too high, and nothing I did seemed to make it go down. I suspect the reason was a lack of metal under the antenna. I fixed the problem somewhat by adding a counterpoise wire that trailed behind the bike. I guess you could call it a "tiger's tail" for 40 meters. Having never gotten around to measuring it, I'll guess I had about 30+ feet of wire attached to the rear end of the Schwinn.

The first rig I tried was a Ten-Tec Scout. I put a 12 volt, 7 amp/hr battery inside the bag under the saddle. I mounted the Scout from the handlebars with a couple of rubber bungee cords and a small hunk of masonite. I now had power and a rig. All that I needed was a CW paddle.

And I made that out of an old Ten-Tec paddle assembly from a KR-series keyer. Nothing fancy, it held together with some Super Glue and cable ties. I fastened the mess to the right handlebar with several nylon cable ties. I could change gears, brake, and send CW, all with my right hand. I could tune the rig with my left hand and steer with the right if need be. Let me tell you, I was happier than a squirrel in a walnut tree!

"What the Heck Is *That!?*"

However, life has never been kind to me, and this project was to suffer the same fate. First off, put this image in your mind's eye: Here's this bright red mountain bike, me with my hot pink Lycra bike shorts, a pair of Italian racing gloves, and a green stocking hat over my helmet. My God, I stop traffic! Now, add on an eight-foot antenna, a radio belching out squeaky noises, and it's time to open up the "X-Files."

Then the trouble began. First, everything worked just fine sitting in the driveway. Although the Scout made quick use of the battery, several contacts were made at the 10-watt RF output from the Scout in its lowest power setting.

"There is no way you can send CW on a bike as you go down the road. The Scout is way too heavy for the Ohio potholes. The roads are too hard on Mike's butt. I'm getting too old for this. And never, never, never trail a wire behind your bike."

But then I started down the road. It became quite clear I could not tune the rig and peddle at the same time. Also, there were the potholes!

Massillon Potholes—Tourist Attraction

In the part of Ohio I live in, we are famous for our potholes. In fact, the city crews feed those critters a special food mix during the winter so they grow up big and deep. It's not at all unusual to hear someone calling for help from deep inside one come early Spring. The potholes really enjoy swallowing up small Fords with gusto! Why, up north towards the big city of Cleveland, Ohio, large groups of people come and just watch the potholes grow.

The first one I ran into knocked the rig all over the band. I moved from the lower end of the CW band to CHU Canada with one monster bounce! The second one bounced the rig right out of the bungee cords. I caught it before the Scout got a case of road rash.

I was not as lucky. Remember my counterpoise wire for the antenna? Well, just as I caught the rig, someone in a huge motor home ran over the wire. I guess you could say they got the tiger by its tail! Anyway, that stopped the bike instantly and up over the handlebars I went. The only thing broken was my pride. Lucky for me, I have an extra layer of fat on my butt. That's great stuff for cushioning a fall. So there I was, my idea flat in the middle of Stratton Avenue. My ego deflated, I hobbled back home.

Here's is what I learned:

There is no way you can send CW on a bike as you go down the road. Nope, I don't care who he is. The Scout is way too heavy for the Ohio potholes. The roads are too hard on Mike's butt. I'm getting too old for this. And never, never, *never* trail a wire behind your bike.

Where There's a Will . . .

But I'm not one to give up so easily. On no, I wanted to operate QRP with the bike, and by God, I was going to do just that. But with a twist. This time, I left the antenna at home. Swapped out the Scout for my Ark-40 and threw in a portable dipole.

I now ride down to Sippo park, grab a picnic table and pull out the gear from the saddlebags. I string the dipole in a tree and have some fun making QRP contacts. And if I get bored, I can always feed cashews to the ducks!

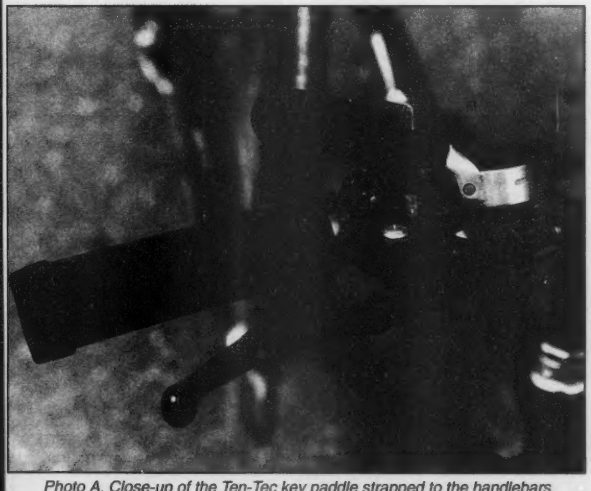

Photo A. Close-up of the Ten-Tec key paddle strapped to the handlebars.

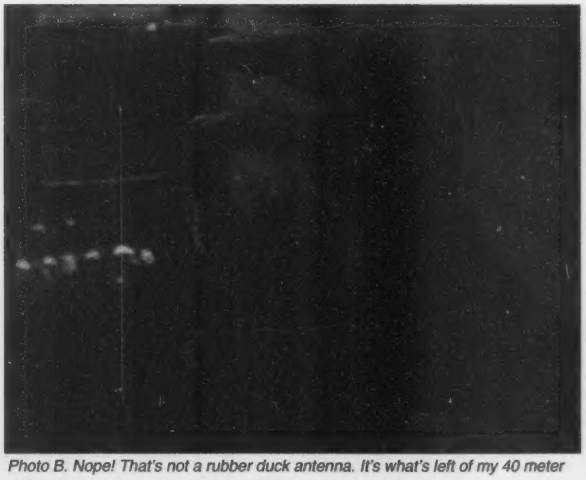

Photo B. Nope! That's not a rubber duck antenna. It's what's left of my 40 meter antenna.

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Never Too Young

I recently had an experience that reminded me of the fact that you never know where or when potential hams may cross your path. Several months ago I met Joe LoVerde, a reporter for *New York Teacher* magazine. He and a photographer came to my school and spent the afternoon with my ham radio classes for an article they were doing.

Joe interviewed many of the children in my program as they gathered around the radio in the ham shack. He listened intently as we checked into the retired airline pilots' net on 14.280 MHz, and was delighted to observe the warm reception we received. Joe also enjoyed listening to the youngsters respond to stations from all over the world on the IMRA net. He had never really known about ham radio before; he made a real learning experience out of it.

One of the things that really impressed Joe was the very natural way that ham radio in the classroom could be used as a motivational tool in all the other curriculum areas. He readily saw the enrichment possibilities in social studies, science, language arts, and math.

Evidently, Joe was excited enough about what he observed in my radio classes that day to go home and recount his day to his family. Joe's eight-year-old daughter, Nicole, was totally enchanted with the stories her dad was telling. She was especially interested in the explanations about my classes having spoken to astronauts, and, of course, to Mickey Mouse in Disneyland, via the ham radio in the classroom.

Nicole lives in Staten Island, where she is a second-grader at P.S. 32 in Mary Jo Kling's class. Her dad describes her as "a very bright kid, who loves school, animals, the Power Rangers, and Elvis. She plays all sports—soccer, basketball, and hockey. She also enjoys dancing school." I would add that she is one of the cutest and most verbal eight-year-olds I've ever met.

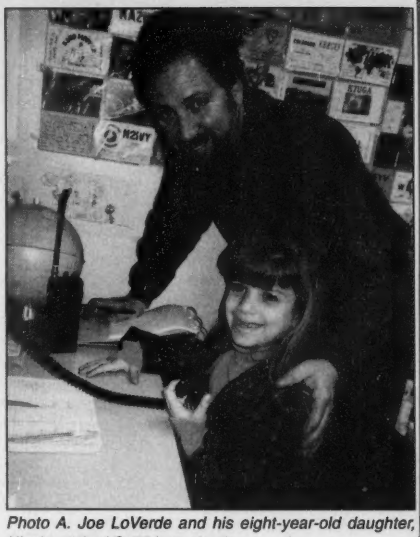

Photo A. Joe LoVerde and his eight-year-old daughter, Nicole, at the I.S. 72 ham shack.

Well, Nicole thought it would be a good idea to do her social studies fair project on "The Uses of Ham Radio Today." So dad arranged for Nicole to come to visit my ham shack after school one day. This thoroughly delightful little girl interviewed me for her project and then accepted my invitation to speak on the 2 meter rig.

I've always been very fortunate in having tremendous support from the local radio clubs. Nicole was warmly greeted by Marty WA2YYX and Barry KB2YDW on the local Staten Island repeater. Both hams welcomed her and her dad to the wonderful world of ham radio after I introduced them on the air.

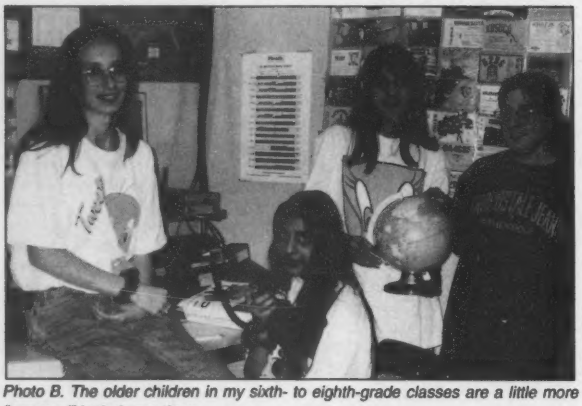

Photo B. The older children in my sixth- to eighth-grade classes are a little more "reserved" in their reactions.

I especially enjoyed watching the smile break out on Nicole's face when she held the microphone and made her first contact. The ages of the youngsters that I deal with every day are 10 to 13. It was a real treat for me to see the excited, uninhibited reaction of this little girl on the radio for the first time. The older children are just a little more reserved in their initial reactions.

We weren't happy that an accident occured while Nicole was on the air, but it was a terrific demo for her to hear the quick and efficient way the hams reported a car crash on the Verrazano Bridge only seconds after it happened. She was able to include that incident in her written report explaining the usefulness of ham radios in the past and today.

Her report described the fun of ham radio as a hobby, and the usefulness of contacting police or other emergency organizations while the problem is actually happening. I was so excited when Nicole called to tell me that she was one of three finalists from her class. All of the finalists from the school had their projects on display in the gymnasium. Medals were given to all the finalists, with a gold medal going to the winner from each class. Nicole got the gold medal for her ham radio project.

The last phone call I got from Nicole was to let me know that she plans to study the Novice material I gave her, and to get her license this summer. We're arranging for her to come to my ham shack after school in the next few weeks so that she can get actual on-the-air experience. It's fascinating to see the ripple effects of sharing your own enthusiasm for ham radio. You never know where the ripples may go. I know you will all join me in wishing Nicole good luck with her studies. I'm sure we'll be hearing more from this talented young lady. 73

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NEVER SAY DIE

Continued from page 4

If you know any hams who aren't reading *73* or *Radio Fun*, please let them know how much you're enjoying the publications. Next year I want to talk with twice as many hams at Dayton who read them. Only about 10% of the hams are subscribing to *73;* that's terrible! How can I get the other 90% to stop smoking and lose weight if I'm not reaching them? How can I get them to try our ham satellites? Slow scan? Packet? How can I maybe even get them to think?

My wife was with me at Dayton, how about yours? Sherry encourages me to buy ham gear, to get on the air and go to hamfests. She did make me promise that we wouldn't go to the banquet, so we had dinner instead with Mike Wengert HL9KT from Seoul. He's made our many visits to Korea lots of fun. He even helped me get my license as HL9WG. He's also lived recently in 9M8 and VS6. Heck, I don't even know who they had as the guest speaker at the banquet this year.

I brought along a suitcase full of my *We The People Declare War On Our Lousy Government* books and sold 'em all. Many readers stopped to say how much they've enjoyed the book. Now, if there were only some way to get one of the presidential candidates to read it! In it I explain a simple way to get any government bureaucracy to cut itself in half within three years and do it enthusiastically. I explain how to cut prison costs by 90%. How to cut health care costs, school costs, and so on. And all with substantial improvements in their services. But so few people care. Oh well, I've written about all that before. I'm running out of copies, but while they're left they're just $10 from Uncle Wayne's Bookshelf.

Sherry is after me to update the book for a second edition, plus add in the 336 pages of my *2020 Foresight* newsletters. Nothing that would probably interest you. Like my proposal for using amateur radio as the key to getting our kids to get into high-tech careers so America will have the workforce it needs to cope with the technology of the 21st century. I'll probably have to add at least a chapter on cold fusion, having gotten interested in that since I wrote the book.

The Flea Market

Hey, for once it didn't rain on Friday and Saturday, making the flea market more fun. It did rain on Sunday, but not much. I didn't even need my umbrella.

If I had the time (and a few more readers and advertisers so I'd have the money to do it) I'd like to double or triple the interest in the flea market. Of course I know how. Step one would be to get the HamVention Committee to allocate the flea market spots much earlier. Step two would be to put together a flyer with inexpensive exhibitor ads showing where we can find what kind of stuff. A Flea Market Guide.

With more and more of the exhibitors dealing in computers and accessories, the attendance at the HamVention could be expanded by attracting a few thousand computer hackers. This wouldn't hurt us hams since most of us are into computers too.

I started to see as many of the flea market exhibitors as I could, but with over 500 of 'em, and it taking me four to five minutes to say hello to each, I soon saw this was a losing battle. I don't know if the HamVention Committee would part with their list of flea market exhibitors or not. Probably not. So such a publishing project probably wouldn't be very successful. It's just that I hate seeing an opportunity to build our hobby being passed by.

For any ham interested in building, the HamVention flea market is a gold mine. Acres of parts at el cheapo prices. What a great place to load up! That's what I used to do when I had the time to build. Whenever I needed a part I'd buy ten, just to make sure. I ended up with a collection you wouldn't believe. Indeed, when I moved everything from my folk's home in Brooklyn to Peterborough it took four van trips, and they were so heavy one load broke the van.

I'd not only completely filled my basement ham shack after 25 years of building, but also our garage, and three of my neighbor's garages I'd rented. By 1965, when I saw that the world was going IC I decided it was time to get rid of my old tubes and large parts. I held one whale of an auction and pretty well cleaned the place out . . . at around a penny on the dollar. Well, money has never been important for me, what I wanted was to find good homes for my beloved parts and equipment.

Every now and then I need a part and have some regrets. But not many.

The Manufacturer's Meeting

When I got back home from Dayton I found a notice in the mail that there was going to be an industry meeting at Dayton. Thanks a bunch. Well, I found out about it anyway and attended. It was run by the *CQ* Gang (as they call themselves). Last year they spent most of the meeting pushing the manufacturers to support their proposed series of commercially run hamfests. I gather that, as I predicted, the hamfests bombed. This year it was other things, but little of the meeting devoted to the main topic of interest to manufacturers: the current recession in the ham business.

The Japanese firms in particular have a big problem: the yen to dollar ratio, which makes it very expensive for them to build their equipment in Japan these days. I came to the meeting with a plan to help them cope with this problem, but when I got there I didn't see any of them attending. As a matter of fact, very few of the manufacturers bothered to come. So we heard at length from the *CQ* Gang and from some ARRL folk.

I have some ideas for what the next generation of ham equipment might look like. That's something I thought the Japanese would want to hear about. Plus my plan would make it possible to overcome some of the yen problems for them, and it would also help rebuild the American ham industry a bit. It was totally destroyed thirty years ago and has never really recovered. At the time I watched with some amusement as the ham industry financed its own destruction with ads in *QST*. Do I see history starting to replay?

What's Gone Wrong

The main problem for the ham industry is (a) that almost all the new hams are no-code Techs, so they're not buying all-band rigs. And, (b) very few of them are upgrading to General, which means the industry is still not selling all-band rigs. Thus, instead of investing maybe $2,000 or so in a rig, tower, and beam, new hams are buying $200 HTs.

"For any ham interested in building, the HamVention flea market is a gold mine. Acres of parts at el cheapo prices."

Then there's the cut-throat dealer competition which has reduced markups to around 25%. If you are involved in retailing you know that dealers have to make more like a 50% markup on merchandise if they are going to make any money. And some industries work on a 100% markup (called "keystone").

Having been a retailer I know the routine. You have to pay for the store, employees, insurance, advertising, shipping, interest on inventory, and so on. A good location can be very expensive. Heck, no part of it is cheap. Even those 800 numbers cost a bundle. By the time I opened five computer software stores and stocked them with merchandise I had a couple of million dollars invested. If I'd have had to sell products with only a 25% markup I'd have been out of business in no time, so it's no wonder we have so few ham dealers these days.

Here we are, finally seeing some newcomers to the hobby, only they are isolated on the VHF bands and thus missing most of the fun the hobby offers. And, with the barrier of the 13-per code test, most of them have opted to live with what they have. So, when we see 3,000 or so newcomers being licensed a month, instead of the industry getting around $6 million in sales as a result, they're getting more like $500,000. By the time that's split among a hundred retailers it's going out of business time.

It gets worse. Of the around 300,000 General and up class licensees, only about a third are active. But let's say they buy a new rig every five years. That's a $1,250 buy every five years, or about $250 a year. And that's not far from what the hams are claiming to be spending in surveys. That comes to around $25 million a year in sales. To put that into perspective, that's about half what the readers of my *CD Review* were spending a *month* on compact discs, and what my *80 Micro* readers were spending a *month* on TRS-80 products. And that was just the readers of my magazines, not the whole industries. It's peanuts.

One thing that would help would be to combine the General and Tech licenses so Techs could get on the low bands. Another would be to go the Japanese route and allow Techs to run 10 watts of SSB on the low bands.

With the biggest ham market in the world being in Japan, American manufacturers haven't a chance to build much of a business. Japan has twice as many hams as we do, and with only half our population! All you have to do is look at their 600-page monthly ham magazine to see the difference. It's filled with fabulous construction projects and a much wider selection of ham gear than we have available. This also helps to explain why Japan is graduating so many more engineers, scientists and technicians than the US. And why almost all of our new electronic products are coming from Japan.

If we're going to attract kids to amateur radio we've got to make their entry more attractive. We're up against computers, computer games, the Internet, and an almost total ignorance of our existence. What we don't need is an artificial and now irrelevant code barrier plus a lack of any planned promotion by our elitist national organization, which has historically ignored and disdained newcomers.

ARRL Vs. FCC

The FCC rules regarding the code tests say nothing about not permitting testees to write down the dots and dashes on the worksheet and then translate them at their sweet convenience. The ARRL instructions to their VECs admits this, but then goes on to suggest that if clubs want to make up their own rules to prevent this that this is their prerogative. Wrongo! That's the way to set up a club for a really expensive lawsuit which could tap any members with deep pockets for a bundle.

I'm on record as absolutely despising hams who sue other hams, so that's something I would never, ever recommend. But if there are any shys . . . er, ham lawyers out there looking

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for some fun with a class action suit, I might be able to put them in touch with some potential clients should any VECs decide to take it on themselves to rewrite the FCC by putting restrictions on worksheet notes or setting arbitrary time limits for the code test. If the FCC had wanted time limits set for the test they would have put that into their rules. Look, I suspect the FCC chaps are as irritated by this code baloney as many of us hams are.

I don't make any bones that I'm out to scuttle the whole damned code test deal. We've proven several thousand times over that this doesn't keep out the bad guys. We're up to here in bad guys, all of whom have passed the code test. What it is doing is discouraging youngsters, the people we need the most if we're going to keep the hobby going. I want to get that lousy mental obstacle out of the way so we can try to attract a few million young hams, instead of the dozens we're getting now. And I don't care how many grumbling old timers I have to run over to get this done. Including those fusty old ARRL directors you can't seem to help yourself from re-electing. What we need is term limits for directors. Like 10 minutes if they are over 50.

Will Anything Change?

Probably not. Unless you decide to do something about it yourself. The ARRL isn't going to change without your pressure. The FCC isn't going to change either, unless you force them with sheaves of petitions.

It's Impossible

When John Campbell W2ZGU, the editor of *Analog*, told me about the Hieronymus Machine I frankly didn't believe him. It was just too preposterous. It violated everything I'd been taught. It violated my experience. It was obviously completely impossible.

"If we're going to attract kids to amateur radio we've got to make their entry more attractive."

Then came Henry Gross' Wishing Machine, which was even more absurd. John was an amazing genius and he was into everything. A lunch with him was like riding an intellectual roller coaster, going into electrochemistry for a few minutes, then into nuclear physics, psychology, sociology, and so on. But when he came up with stuff that was patently absurd, even though the machines had been patented, I rolled my eyes.

I had the same reaction when pyramids came along. Little paper pyramids can sharpen razor blades? Sure. And mummify dead animals? Har-dehar. But what if little paper pyramids really can sharpen razor blades and there are photomicrographs to prove it? What do you do when something is clearly impossible, yet it happens?

Well, G. Harry Stine has fiendishly come up with seven machines you can build for yourself and test. They're all simple to make, and the really irritating part is that every blessed one of them works for most people. None of them should or even could possibly work. The nice part of it is that they all will work whether you believe they will or not. Even worse, they'll work with the double-blind scientific test too. You're going to have to face the fact that they all do work and that we haven't a scientific clue as to why.

The scientific approach to all this is to pooh-pooh it and not bother to test any of them since there's no known way they can possibly work. That's the approach some old line scientists have used with cold fusion, and never mind the dozens of labs around the world generating completely unexplainable large quantities of heat. It isn't possible, therefore there's no reason to check it out.

Now, if you'd like to upset yourself and prove the completely impossible is real, invest in Stine's book. It's 207 pages in paperback and is available from Top of the Mountain Publishing, Box 2244, Pinellas Park, FL 34664. Send $18 (postpaid) for Stine's *Amazing and Wonderful Mind Machines You Can Build.*

The book shows the tube version of the Hieronymus Machine, as well as a transistorized version, and even a new IC model that you can assemble in a few minutes. This gadget will tell you what metals are in anything you put by the input coil, and what percentages of each metal. This, of course is completely impossible. But it gets worse. You detect the presence of metals by feeling a plastic or glass plate which is over the output coil. Yes, this fool thing will work whether you believe it or not. It'll work for most people, but not all. Around 80%. And for those for whom it works, it works repeatably, even when the operator has no clue as to what is being tested.

It gets worse. The damned thing keeps right on working with the power turned off. Working repeatably. Now explain *that* to someone. But, alas, it gets even worse. It turns out you can

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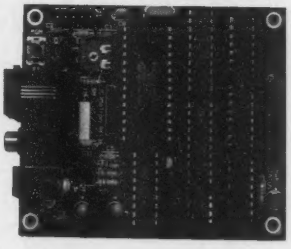

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CIRCLE 169 ON READER SERVICE CARD

replace that IC circuit with an inked drawing of the circuit, connected to the input and output coils with thread instead of wire and it keeps right on working, like the Energizer Bunny. You do have to re-ink the battery drawing now and then to keep it running. Apparently the battery drawing runs out of juice when the ink begins to fade.

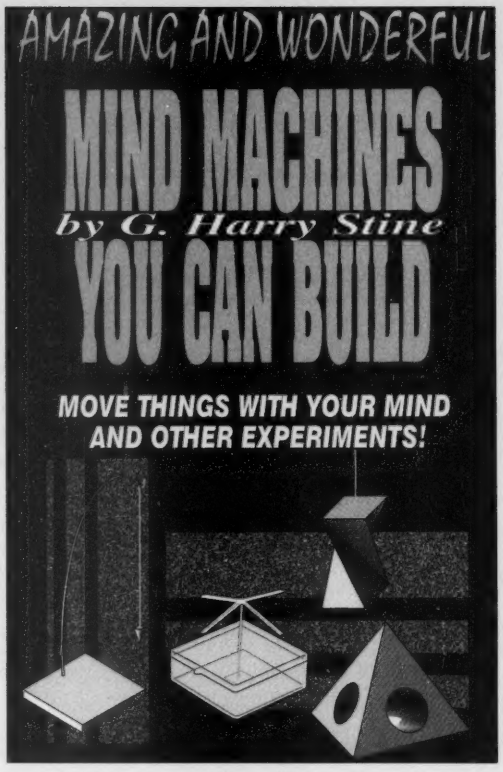
All this is pure hokum, right? It's so foolish you'd never try to build even the simple machines that Stine describes in detail. It's not worth reading about. Okay, fine, don't look through Galileo's telescope. Don't hang a couple nickels in a potassium carbonate solution and see if excess heat is generated. Laugh and jeer at gullible old Wayne. Obviously I'm losing what's left of my marbles. Well, that's what a bunch of readers were saying when I started pushing 2m FM and repeaters back in the 1960s. They said it again when I pushed microcomputers in 1975. I sure must have started out with one big bag of marbles to lose so many and still keep going. So make poor old Wayne look dumb. Get the book, build the gadgets Stine describes, and prove they positively won't work by testing them yourself and on a bunch of friends.

My grandfather showed me how to dowse with a beech tree branch when I was about seven years old. It worked for both of us. Dowsing works just fine for people all around the world. They dowse for water, oil, minerals, underground pipes, and so on. Nobody has a clue as to how or why dowsing works, so the pathological skeptics just refuse to accept it. To me, when something unexplainable happens, that's the time to start finding out why, not the time to say it's all a fake, never happened, and ignore it. We've lost a lot of valuable knowledge and experience via pathological skeptic pressure.

Just look at what the head of the DOE has been able to do to the American cold fusion research effort. He almost single-handedly has put America way behind many other countries in this new field, Japan in particular. The cold fusion pioneers in India and Italy are heroes, here they were ridiculed and humiliated. Well, that's what happens when our government gets involved with just about anything. The government seems able to screw up everything it does.

Virtually every major contributor to health care cost escalation has been caused by government meddling. Ditto our school system, which is the worst in the developed world and making us less and less competitive with the far better educated people in other countries. When Bulgarian school kids easily outperform ours it's almost time to do something about getting the government out of the education business. I keep harping on that, don't I? Well, you aren't *doing* anything.

Now send for that book and stop procrastinating. And renew your subscription to *73* while you're at it. Heck, subscribe to *Radio Fun* too—it's only $35 for the combo. (Every radio and TV program ends with a commercial, right?)



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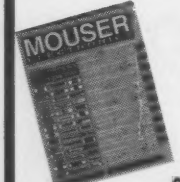

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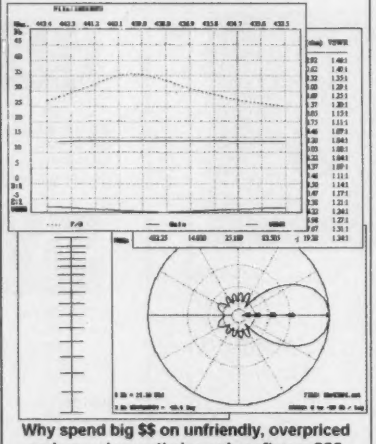
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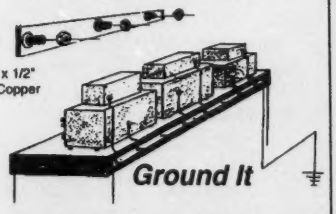

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SPECIAL EVENTS

Ham Doings Around the World

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JULY 8

PETOSKEY, MI The Straits Area ARC will sponsor a Swap & Shop, 8 AM-1 PM, in the 4-H Bldg. at Emmet County Fairgrounds. Talk-in on 146.68. For info, call *Harry Leiber N8OIV, (616) 347-6610.*

SALISBURY, NC The North Carolina "Alligator Group" will sponsor a "Firecracker Hamfest," 8 AM-2 PM at the Salisbury Civic Center. Auction at 1 PM. VE Exams at 1:30 PM, pre-reg. required, with 610, copy of license, and current fee sent to *Isabell Ledford, P.O. Box 826, Coolemee NC 27014.* For Hamfest reg., write to *Walter "Alligator" Bastow, 3045 High Rock Rd., Gold Hill NC 28071.*

SOUTH MILWAUKEE, WI The 26th annual "Swapfest" of the South Milwaukee ARC, Inc., will be held at the American Legion Post #434 grounds, 9327 S. Shepard Ave., Oak Creek WI, 7 AM-2 PM CDT. Talk-in on 146.52 simplex and on local Rptr. For a free flyer, write to *The South Milwaukee ARC Inc., P.O. Box 102, South Milwaukee WI 53172-0102. Tel. (414) 762-3235.*

JULY 8-9

INDIANAPOLIS, IN The Indianapolis Hamfest Assn. will host the ARRL Central Div. Convention, and a Ham Radio/Electronics Flea Market, at the Marion County Fairgrounds. K9YJW will provide Talk-in, from 6 AM each morning, on 146.76(-) and 443.25(+). Contact *Indianapolis Hamfest Assn., P.O. Box 88677, Indianapolis, IN 46208. Tel. (317) 251-4407.*

JULY 9

BALTIMORE, MD The Baltimore Radio Amateur TV Soc. will hold its annual Maryland Hamfest/Computer Fest at the Maryland State Fairgrounds in Timonium. Vendor setup 2 PM Sat., July 8th. Tailgating area opens 6 AM, Sun. Buildings open 8 AM. VE Exams at 10 AM only. Pre-reg. required. Call *Les McClure W3GXT, (410) 833-8667.* Talk-in on 147.03/R and 224.96/R. For info, contact *BRATS Hamfest, P.O. Box 5915, Baltimore MD 21208. Tel./FAX (410) 467-4634.*

HINSDALE, IL Dupage ARC Hamfest Computer Show '95 will be held at Santa Fe Park, 91st and Wolf Rd. Commercial and Flea Market Set-up 6 AM. Hamfest hours 8 AM-3 PM. No VE Exams. Talk-in on the DARC 2M 145.250. Contact *Edwin Weinstein, 7511 Walnut Ave., Woodridge IL 60517. Tel. (708) 985-0527 eves.* Send SASE with check payable to *DARC, Hamfest '95, 7511 Walnut Ave., Woodridge IL 60517.*

PITTSBURGH, PA The North Hills ARC will hold their 10th annual Hamfest 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. Talk-in on 149.69/.09 North Hills ARC Rptr. Contact *Gregg Corsello K3QK, 2021 Red Coach Rd., Allison Park PA 15101. Tel. (412) 366-7006.*

JULY 15-16

MISSION, BC, CANADA Maple Ridge, Mission and Abbotsford ARCs will present the 2nd annual AREP Expo and Ham/Computer Swap Meet, 9 AM-4 PM, at Mission Rec Center, 7th and Talbout St. Set-up at 8 AM. For info, write to *MRARC, 32750 Cherry Ave., Mission BC V2V 2T7, Canada.* For table reservations, call *Rob VE7JOK, (604) 826-8445; Terry VE7TAG, 465-5710; Steve VE7IIF, (604) 826-8445; or Fraser VE7OAB, (604) 826-7020.*

JULY 16

NEWTON, NJ The Sussex County ARC will hold its 17th annual Hamfest at the Sussex County Fairgrounds, Plains Rd., Augusta NJ, starting at 8 AM. Talk-in on 147.30/R, 224.50/R, and 146.52 simplex. Contact *Daniel Carter N2ERH, 8 Carter Ln., Branchville NJ 07826. Tel. (201) 948-6999.*

VAN WERT, OH Van Wert County Fairgrounds, US 127 South, is the location for "Hamfest '95," which will be held in the Commercial Bldg. by the Van Wert ARC, 8 AM-3 PM.

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CIRCLE 68 ON READER SERVICE CARD

Talk-in on 146.850. VE Exams if you can pre-register by July 9th; send SASE or call *Bob High KA8IBF, 12838 Tomlinson Rd., Rockford OH 45882. Tel. (419) 795-5763.* For Hamfest info, call *Bob High, (419) 795-5763 before 5 PM; Bob WD8LPY, (419) 238-1877 after 5 PM.*

WASHINGTON, MO The Zero-Beaters ARC will hold its 33rd annual Hamfest at Washington City Park. Gates open at 6 AM. Registration for VE Exams will start at 9 AM. Talk-in on 147.240(+). Contact *ZBARC, P.O. Box 24, Dutzow MO 63342;* or call *Dave Randolph N0GLN, days, (314) 532-2477; eves. (314) 764-4999.*

JULY 21

NEWINGTON, CT The 14th Annual ARRL Digital Comm. Conf. will be held Sept. 8-10, 1995, at the La Quinta Conf. Center in Arlington TX. Anyone interested in digital communications is invited to submit a paper for publication in the *Conference Proceedings*. Presentation at the Conference is not required for publication. Papers are due by July 21st, and should be submitted to *Maty Weinberg, ARRL, 225 Main St., Newington CT 06111 USA;* or via Internet at *lweinberg@arrl.org.* Please contact Maty for detailed format requirements. For more info on the Conference, registration, and hotel reservations, contact *TAPR, 8987-309 E. Tanque Verde Rd. #337, Tucson AZ 85749-9399, USA. Tel. (817) 383-0000. FAX (817) 566-2544. Internet: tapr@tapr.org.*

JULY 21-23

PHOENIX, AZ The ARCA Ft. Tuthill Hamfest will be held at Coconino County Fairgrounds, Flagstaff AZ. Contact the *Amateur Radio Council of Arizona, (602) 440-2039,* for reservation info. VE Exams Sat. July 22nd, at 8:30 AM. No-code Tech class - contact *Morgan Riley N7DLW, (602) 938-4356.*

JULY 23

FREDERICK, MD The Mid-Atlantic DX & Rptr. Assn. will hold a Hamfest at the Marc Train Station in Brunswick, Frederick Cnty., Md. VE Exams. Flea Market. Brunswick Train Museum. Tent/Indoor spaces must be pre-reg.; write to *MADRA Hamfest '95, 230 N. Potomac St., Hagerstown MD 21740.* Talk-in on 147.060/448.125 MHz Rptrs.

JULY 27-29

COLORADO SPRINGS, CO The Central States VHF Soc. Annual Conference will be held at the Sheraton Colorado Springs Hotel, 2886 South Circle Dr. For Hotel Reservations, call *(719) 576-5900, or (800) 325-3535.* Be sure to ask for the Central States VHF Soc. rate. For Conference info, contact *Lauren Libby KX0O, (719) 593-9861;* or *Hal Bergeson W0MXY, (719) 471-0238.* E-Mail to *75151.2442@COMPUSERVE.COM (KX0O)* or *BERGESON@PPCC.COLORADO.EDU (W0MXY).* A special "Youth Program" for young hams, and beginners in VHF (regardless of age) will be offered on Fri. morning.

JULY 28-29

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor their 22nd annual "Ham Holidays '95" at the Oklahoma State Fair Park (Hobbies, Arts & Crafts Bldg.). Doors open 5 PM-8 PM, Fri., July 28th; 8 AM-5 PM, Sat., July 29th. Technical and non-technical programs, Fox Hunt, VE Exams, Flea Market. Talk-in on 146.67. Address all inquiries to *Ham Holidays '95, P.O. 851281, Yukon OK 73085-1281;* or *CompuServe 75672,3475.*

JULY 29

ASHEVILLE, NC The 20th annual Western Carolina Hamfest will be held 8 AM-4 PM at the Haywood County Fairgrounds, near Waynesville NC. Sponsor: Western Carolina ARS. Talk-in on 146.16/.76 and 146.31/.91. Contact *Tommy Queen K4BNP, 12 Lynwood Circle, Asheville NC 28806. Tel. (704) 258-2639.*

CARLINVILLE, IL Macoupin County ARC, Inc. will hold their Computer Fair/Hamfest '95 at the Macoupin County Fairgrounds, 1/2 mi. north of Carlinville, on Rte 4, starting at 8 AM. Setup the night before or at 6 AM. Vendors, contact *Doug KA9HDZ at (618) 488-7249.* VE Exams, all classes, pre-reg. required. Call *(217) 854-8261.* For info, call *Dennis N9LQC, (217) 854-2365.*

KINGSFORD, MI The Mich-A-Con ARC will host the Upper Peninsula Hamfest in the Iron Mountain-Kingsford area at the United Sportsman Club in Merriman MI, starting at 8 AM. Setup at 7 AM, CST. Contact *William Bertoldi, Jr. KB8SBP, 709 Hamilton Ave., Kingsford MI 49801. Tel. (906) 774-0419;* or *Lou Gembolis KG8NK, 441 Balsam, Kingsford MI 49801. Tel. (906)774-2930.*

AUG 5

CLAYTON, NY The Jefferson County RAC, will hold their Hamfest 7 AM-5 PM, at the Clayton Rec. Park Arena. VE Exams at 9 AM; walk-ins welcomed. Talk-in on 146.70/.10. Contact *Jefferson County RAC, P.O. Box 523, Brownville NY 13615.*

AUG 6

ANGOLA, IN The annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held 7 AM-2 PM at Steuben County 4-H Fairgrounds, corner of 200 W & 200 N, at Crooked Lake in Angola. Vendor setup 3-10 PM Sat., Aug. 5th; 4AM-7 AM Sun., Aug. 6th. VE Exams for all classes; sign up at 9 AM. Chicken BBQ. Talk-in on 147.180/.780 and 444.350/449.350 131.8 Tone. For Tickets, please contact *Land of Lakes Angola Hamfest, Sharon Brown WD9DSP, 905 W Parkway Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 4th annual Picnic, beginning around 11 AM in Wildwood Park. Potluck. Swapfest. Talk-in on 147.180. All are welcome. Contact *Guy A. Boucher KF9XX, 107 West Third St., Marshfield WI 54449. Tel. (715) 384-4323. Packet: KF9XX @ W9IHW.WI.USA.NA.*

PEOTONE, IL A Hamfest/Computer Festival will be held at Will County Fairgrounds 6 AM-?, by the Hamfesters RC, Inc. Setup Sat. Aug. 5th 3 PM-11 PM. The main exhibition hall opens at 8 AM. Contact *John Fleming, 13800 Division St., Lot 215, Blue Island IL 60406. Tel. (708) 489-5872.*

SPECIAL EVENT STATIONS

JULY 4

WILLIAMSBURG, VA The Williamsburg Area ARC will operate KE4YVV 1300Z-2300Z, to celebrate the 219th Anniversary of the signing of the Declaration of Independance. Freq: 28.350, 24.950, 21.350, 18.150, 14.270, 7.270 and 3.870. For an unfolded certificate, send QSL and a 9" x 12" SASE to *Hershel Kreis KE4GWV, 145 Sand Hill Rd., Williamsburg VA 23188-6609.*

JULY 8

SIOUX FALLS, SD The Sioux Empire ARC will operate W0ZWY 1400Z-2200Z to commemorate the U.S.S. South Dakota BB 57 (WWII Battleship X) 50th Nat'l Reunion. Operation will be on CW and phone on the 80-10 meter bands. For a QSL certificate, send QSL and SASE to *SEARC, P.O. Box 91, Sioux Falls SD 57101.*

SOUTH POINT, OH The Lawrence County OH AR Emergency Services group will operate the Lawrence County OH Ohio River AR "River Days" Special Event Station WN8F, from aboard the Jewell City Sternwheeler. The event will run 11 AM-4 PM. Freq. 2M 146.715 & 146.610 Linked; 10M 28.400; 20M 14.240; 40M 7.240. Packet will also be on display and operating. Brochures about amateur radio and emergency services will be available to the public. Also, visitors will be encouraged to send a message to a friend Via Ham Radio.

JULY 9

WESTERN NEW YORK The ATV Group of Western NY will launch its second High Altitude Helium Balloon at 9 AM. Live video may be received on 439.25 MHz, 2M CW beacon on 144.34, and local 40M net, starting at 8:30 AM on 7.290 MHz +/- QRM. Overlay on video will display the call sign of WA2CXW, along with altitude, temp., and other info. For details, call *Roger Garbacz WA2CXW, (716) 937-4478.*

JULY 13-15

SACRAMENTO, CA The Sacramento ARC will operate W6AK 8 AM-8 PM Pacific Daylight Time, to celebrate the Folsom Powerhouse Centennial. Operation will be voice on 10, 15, 20, 40 and 80 meters. The 10, 40, and 80 bands will probably be used the most. A special Centennial QSL Card will be sent to stations worked that send an SASE to *The Sacramento ARC, P.O. Box 161903, Sacramento CA 95816-1903.*

JULY 15-16

PLYMOUTH, MA The Mayflower ARC will operate KB1BQJ from the waterfront "Harborfest," 1400Z-2100Z, in honor of the 375th Anniversary of the landing of the Pilgrims at Plymouth Rock. Operation will be in the General portion of the 40, 20, 15, and 10 meter bands. For a certificate, send SASE to *MARC, P.O. Box 766, Plymouth MA 02362-0766.*

KINGSPORT, TN The Bays Mountain Radio Club and the Kingsport ARC will operate W4ZJA 1700Z-2400Z on July 15th and 16th, to commemorate the 75th Anniversary of their sponsor, Eastman Chemical Company. Operations will be on the General portion of the 40 and 20 meter phone bands, and the Novice portion of the 10 meter subband. For a certificate, send a QSL and a 9" x 12" SASE, along with your contact number, to *W4ZJA, Bays Mountain Radio Club, P.O. Box 3168, Kingsport TN 37664.*

JULY 15 & 22

RACINE, WI The Racine Megacycle Club will operate club station W9UDU to celebrate the 21st Anniversary of the largest Lake Michigan fishing contest, "The Big One," Salmon-A-Rama, July 15th and 22nd, from 1500Z-1900Z. Operation will be on the lower 25 kHz of the General 20 and 40M phone/CW bands, and 28.400 MHz. Contact may also be made on 147.27(+) (Lakeshore Rptr). Packet operators may connect with W9UDU@K9RRS.EN62GK.WI.USA.NOAM; Subject: Salmon-A-Rama; Text: Finish the sentence: Fishing

Lake Michigan is great because . . . For a certificate, send your QSL and an SASE to the *Racine Megacycle Club W9UDU, Box 3, Racine WI 53401-0003.*

JULY 16

SOCORRO, NM The Socorro ARA will operate NA5N from 1100-1700 UTC, from near Ground Zero - Trinity Site - in the Central New Mexico desert, to commemorate the 50th Anniversary of the world's first atomic bomb test. Listen on the General phone and CW portions of the 80, 40, 20, 15, and 10-meter bands (depending on propagation). A QRP station will operate in the QRP frequencies of 7.040, 14.060, 21.060 and 28.060 MHz. For a QSL/Certificate, send QSL and business size SASE to *Socorro ARA, Trinity Site Event, P.O. Box 522, Socorro NM 87801.* Trinity Site will be open to the public the morning of July 16th. The White Sands Missile Range Stallion Gate (east of San Antonio NM) will be open to the public 5 AM-11 AM MDT. On July 15th, the Nat'l Radio Astronomy Observatory will offer guided tours of the Very Large Array radio telescope, west of Socorro.. For info and accommodations, contact the *Socorro County Chamber of Commerce, P.O. Box 743, Socorro NM. Tel. (505) 835-0424.*

JULY 20-23

COLORADO SPRINGS, CO The International Tesla Soc. will operate KC2Q/0, 1600Z-2400Z, daily, on 7.297, 14.297, 21.397, and 28.397. KC2Q/0 will QSL directly to YOU.

JULY 22-23

STRATFORD, NY The Fulton County Mahlon Loomis Committee will operate W2ZZJ, 1300Z-2000Z, each day, on the General class phone portion of 40, 20, and 15 meters, and on the Novice 10 meter phone band; also, on area 2 meter FM Rptrs. This is to celebrate the 169th Anniversary of the birth of Dr. Mahlon Loomis, the American wireless telegraphy pioneer. For a certficate and literature, send QSL, contact number, and #10 SASE to *W2ZZJ, 5738 STHWY 29A, Stratford NY 13470.*

JULY 27-AUG 2

GREENVILLE, NC The following stations will operate during a DXpedition to St. Paul Island (CY9): Ron AA4VK/CY9; Murray WA4DAN/CY9; Bob KW2P/CY9; Vance W5IJU/CY9. Operation will be on all bands 160M-6M. Modes: SSB, CW, and RTTY. QSL via *Murray D. Adams WA4DAN, 403 East 14th St., Greenville NC 27858.*

JULY 29

EAST GREENWICH, RI The Fidelity ARC will operate K1NQG 1300Z-1800Z, to coincide with the annual Yankee Tune Up at the New England Wireless and Steam Museum. Phone: lower portion of the 20 meter General subband; CW: the Novice portion of the 40 meter band. For a certificate, send QSL and SASE to *Bill May N1LEJ, 20 Montana Ave., Coventry RI 02816.*

JULY 29-30

RUTLEDGE, TN The Lakeway ARC will operate KS4QK 1400Z-2300Z in conjunction with the Grainger County Tomato Festival. Operation will be in the middle of the General 20, 15, and 10 meter Novice phone subbands, and 146.50 2 meter. For a certificate, send $1, a 6" x 9" SASE, and your QSL card to *Perry R. Hensley, R #3 Box 566A, Rutledge TN 37861-9300.*

AUG 4-6

LANNON, WI Members of the Milwaukee ARES will operate W9WK to celebrate the 5th annual "Picnic Ham" held at Menomonee Park. Operation will be in the General phone and CW bands on 75, 40, 20, 15, and 10 meters. For a certificate, send QSL and a 9" x 12" envelope (with 2 units of postage) to *W9WK, c/o John Leekly, 757 N. Broadway, Suite 306, Milwaukee WI 53202.*

AUG 5

ROCHESTER, NY The AUXHAMS, the U.S. Coast Guard Auxiliary AR Operators, will operate WA2RXE, 1400Z-2000Z, to celebrate the Birthday of the US Coast Guard. Operation will be in the lower General phone portions of the 80, 40, 20, and 15 meter bands, the Novice 10 meter subband, and 146.925 Rptr. For an unfolded certificate, send QSL and 9" x 12" SASE to *AUXHAMS, WA2RXE, P.O. Box 90411, Rochester NY 14609.*

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HAM HELP

Number 24 on your Feedback card

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WANTED: Details of "Cold Plating" as advertised in *Popular Mechanics* or *Popular Science. Keith R. French, P.O. Box 9, Berowra NSW 2081, Australia.*

I need a REGENCY Regulator 5700 Controller, or someone who can repair it for me. *Ed Quinn, P.O. Box 91, Sewaren NJ 07077-0091.*

The San Francisco Shriners Hospital for Crippled Children has a stamp club for inpatients, as well as for recovering outpatients, that have an interest in stamp collecting. Children are given a stamp album when they are in for treatment, and stamps are regularly distributed and forwarded to club members. Their current need far outweighs present contributions. They would greatly appreciate any foreign stamps (and/or foreign coins and currency) being forwarded to them at *San Francisco Shriners Hospital for Crippled Children Stamp Club, 1701 19th Avenue, San Francisco CA 94122.*

I am in need of manuals for the following: (1) SHEA-TRON Amp. It is a 10W in, 100W out VHF amp. Frequency range is 136-175 MHz. (2) OLYMPIA Electronic Compact RO. It is a printer only; no keyboard. I will gladly pay for expenses to get these manuals. *Bill Fletcher AF9B, 4358 Crawford Dr., Madison WI 53711-4849.*

I am looking for schematics and/or a manual for a LAYFAYETTE HE-20T CB transceiver. I will pay for copies and/or postage. *Brent Putnam, 14-B Debra Ann Ln., E. Falmouth MA 02536.*

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The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine*, 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the September 1995 classified ad section is July 13, 1995.

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
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Conditions This Month

July is not expected to be a very good month for DX on the HF bands. The poorest days are likely to be: 5-6, 9-10, and 29-30. The best days should occur on: 1-3, 12-15, 21-23 and 25-27. As you can see from the daily chart, HF signal propagation for the remainder of the month is anticipated to be Fair or transitioning. Poor weather and/or other remarkable geophysical phenomena could center around the 5th, 18th, and 29th.

10, 12, and 15 Meter Bands

Sporadic E propagation on many (G) or (F) days, with good signal strengths of short duration and quick fading. The ionized clouds drift with the high-altitude winds. Expect skip to 1,500 miles or so, and beam across the equator for possible contacts in the opposite hemisphere. These bands will close at sunset.

17 and 20 Meter Bands

Twenty will be best, and sometimes 17 will be almost as good, but not as heavily occupied. If open, the higher-frequency band will provide the longest skip. Twenty will remain open after sunset and sometimes late into the evening. Seventeen will close at dark or shortly after. Possible grey-line DX along the terminator is a bonus.

30 and 40 Meter Bands

Excellent nighttime possibilities on evenings when QRN is low and "conditions" are Good. Thunderstorms between you and your target can make copy difficult if not impossible. Daytime short skip out to 1,000 miles is frequent, and nighttime skip to 2,000 miles or more will occur less regularly. Thirty meters will behave more like 20, and 40 meters will behave more like 80 on many occasions, due to the height of the reflecting layer at that time. Always check the next-higher and next-lower bands.

80 and 160 Meter Bands

Expect lots of QRN. You'll hear very few signals on 80 during the day, and none on 160. These bands are the nighttime bands in summer, and it pays you to keep a sharp ear open after sundown. On particularly good nights with low noise, you will find both long skip and DX on both bands. Avid DXers must be patient, however, because in summer there's almost always noise present. I'd recommend that you use the long summer days and evenings for building up better antennas for these bands, and wait until fall for conditions to improve. W1XU

JULY 1995

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F-G
2 G	3 G-F	4 F-P	5 P	6 P-G	7 F	8 F-P
9 P	10 P	11 P-F	12 F-G	13 G-F	14 F-G	15 G-F
16 F-P	17 P	18 P	19 P-F	20 F	21 F-G	22 G
23 G-F	24 F	25 F-G	26 G	27 G-F	28 F-P	29 P
30 P	31 P-F					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA								15	15	15		
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA									15	15	15	
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA									15	15		
U.S.S.R.								20				
EAST COAST		80	80	40	40	40	40	20	20	20		

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SB-7	6.4 x 2.7 x 1.1	13.20
SB-8	2.6 x 2.7 x .63	7.00
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SB-10	4.8 x 2.7 x .63	8.00
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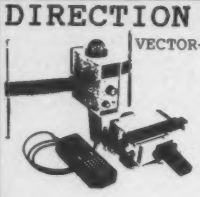

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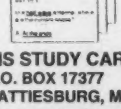

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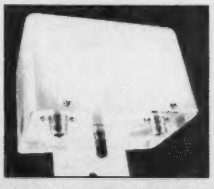

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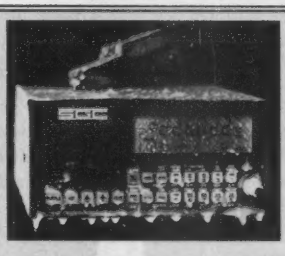

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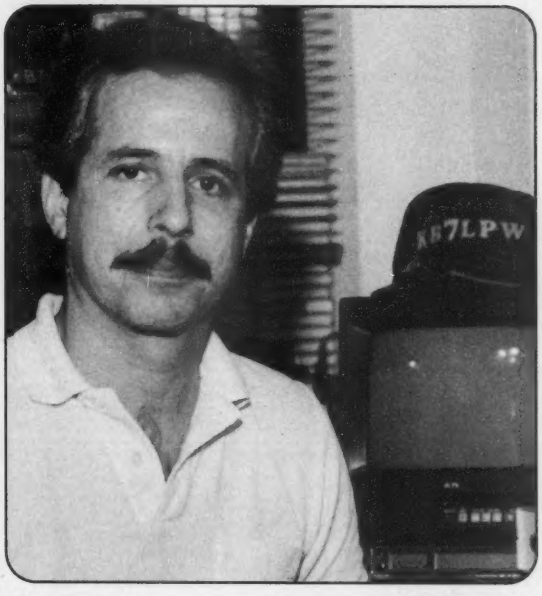

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AR4092 **Your RTTY/AMTOR Companion** invites you to explore the world of HF digital communications. If you've never operated RTTY or AMTOR before, this book is written expecially for you! You won't find complicated technical jargon here. Just information you can use right away. You'll discover how to . . . Assemble your own RTTY/AMTOR station . . . Use RTTY and AMTOR to talk to amateurs throughout the world . . . Compete in RTTY/AMTOR contests . . . Hunt for digital DX. **$8.00**

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TAB 339643 **Tuning In To RF Scanning** From Police to Satellite Bands. Bob Kay. 150p 1994, Tab Books. This is a wonderful book for the VHF-UHF scanner listener. It explains about the various radio bands, antennas, the laws, and lists frequencies for every imaginable service . . . including the Secret Service, FBI, military, IRS, prisons, Fish & Wildlife, McDonald's order windows, nuclear search teams, railroads, Russian satellites, Treasury Dept., wireless microphones for concerts, and so on. **$14.95.**

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TAB 3270P **Practical Antenna Handbook**—Second Edition, 1994, Joseph Carr; Tab Books. This 560-page book is a real treasure. Sarts with the fundamentals of antenna and feedline theory, explains about propagation of all kinds, and then provides a ton of easy antenna construction projects. Covers antennas and feeders for all bands. The explanations are simple and well illustrated, with some math, where it's unavoidable, but it won't bog you down. It even has the ZL-Special antenna, which I've used on 20m with some spectacular DX-ing success. A low angle of radiation and made it so I could always work the rare stuff first . . . Wayne. **$26.95.**

AR4734 **ARRL Antenna Book** The new 16th Edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. **$30.00**

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AR3819 **Physical Design of Yagi Antennas** *by David B. Leeson W6QHS* provides the tools here to design and build robust Yagi antennas, using sound mechanical engineering principles. You need no longer fear the consequences of wind or ice storms on your antennas. With this information, you can build or "beef up" existing Yagis. **$20.00**

AR2618 **W1FB's Antenna Notebook** *by Dave DeMaw W1FB* Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$10.00**

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ARTSCI **U.S.Repeater Mapbook** *by Robert Martin* The Guide for traveling radio amateurs. **$9.95**

TP001 **The Basic Guide to VHF/UHF Ham Radio** *by Edward M. Noll* Provides a first rate introduction to the 2.6 and 1.25 meter bands as well as 23, 33, and 70cm. **$6.95**

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BOOKS FOR BEGINNERS

TAB4354 **The Beginner's Handbook of Amateur Radio, Third Edition** *by Clay Laster W5ZPV,* 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. **$22.00**

W5GWNV **No-Code Video, Manual, Part 97 Rules** Learn how to be a ham radio operator. **$29.95**

W5GWNC **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

XTAL-1 The Crystal Set Handbook by Phil Anderson WØXI. Want to give a kid an exciting present? Or maybe yourself? Crystal sets are alive and fun. Here's a whole book packed with crystal set circuits that anyone can build. Now start saving those oatmeal boxes, okay? 133 pages **$10.95**

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WG4 **20/20 Foresight**—Twenty 16p updates on the **Declare War** book—320p. Further proposals for solving critical American problems, such as a new approach to financing small businesses, how to finance Russia and other countries and make a profit doing it, the real dope on bioelectromagnetics, a new kind of polytechnical university, a new electronics technology, why Africa is in such a mess, why Perot bombed, how to have tuition-free universities, a plan for making Congress turn honest, etc. Plenty more. Ridiculously priced at **$10**.

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WG6 **Uncle Wayne's Caribbean Adventures**—96p. Wayne's adventures scuba diving all around the Caribbean, visiting ham operators, and sightseeing. If you're interested in how to travel economically, you'll get some great ideas from this. He starts out with his "Diving, the Wimp Sport." You'll love the visits to 11 islands in 21 days trip. A measily **$7.50**.

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73T20 **"Courageous" $5.95 20+ wpm** Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per.

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MFJ-9420 has a real calibrated S-meter, not a useless bargraph, making it a peaking tuner, so finding the best beam heading is clear-cut. The meter also monitors speech processing levels during transmit. No annoying synthesizer jump or obscure keypad commands to deal with. Enjoy effortless tuning with a custom-built reduction drive ball-bearing VFO capacitor.

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The conservative design features premium plated-through PC board, quality components, handsome brushed-aluminum panel, and a tough vinyl-clad case to ensure years of dependable service. The unit carries MFJ's "No Matter What" full one-year unconditional guarantee.

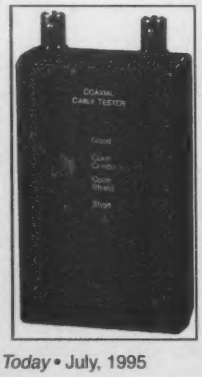
For more information or to order, contact any MFJ dealer or MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-5869, fax: (601) 323-6551, or toll-free orders (800) 647-1800. Or circle Reader Service No. 203.

MAGGIORE

Maggiore Electronic Laboratory has announced the Model R1 Repeater line with a starting price of $589.00. Used as a main system or a backup, the units start as a complete receiver and transmitter in a rack-mountable, 19" x 3.5" x 9" deep, completely enclosed steel cabinet, with DC power cord, panel-mounted fuse and power switch. Separate compartments house transmitter, receiver, and controller. All repeaters are designed for 100% duty cycle at -20° to +60° C and are available in power outputs from 5 watts to 35 watts in VHF and 2.5 watts to 20 watts in UHF. Power outputs adjust easily in matching high-power amplifier inputs. All repeaters now come with the new Hi Pro Studio Quality Audio and ultra stable Hi Pro TCXO Oscillators. A computer-controlled, voice-synthesized CAT-300 with autopatch and autodialers, voice messages, and controller inputs and outputs is also available installed. All repeaters include a 2-year warranty. For more information, contact Maggiore Electronic Laboratory, 600 Westtown Rd., West Chester, PA 19382; (610) 436-6051, fax: (610) 436-6268. Or circle Reader Service No. 201.

RF INDUSTRIES

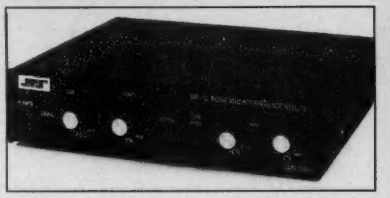
RF Industries introduces the RFA-4017-1 Coaxial Cable Tester. With this convenient, low-cost cable assembly tester, the bench and field technician can quickly and easily test cables with BNC male ends. Adapters (sold separately or packaged in the RFA-4017 kit) enable the technicians to test cables with termination other than BNCs.



The cable tester, powered by a 9-volt battery, is lightweight, small, and completely portable. The LED panel of the front of the tester indicates pass or fail. If the result is fail, the panel saves you valuable diagnostic time by indicating whether the failure is due to a short, open conductor, or open shield. Installed cable can easily be tested by using two testers.

Available from RFI distributors throughout the US, Canada, and Mexico. For more information, contact RF Industries, Ltd., 7610 Miramar Rd., San Diego, CA 92126-4202; (619) 549-6340, (800) 233-1728, fax: (619) 549-6345. Or circle Reader Service No. 205.

JPS COMMUNICATIONS



JPS Communications, Inc., announces the most advanced DSP noise reduction and filter unit available to Amateurs and SWLs: the NIR-12 Noise & Interference Reducer and Filter Unit. The unit is a state-of-the-art audio signal processor designed to provide the user with maximum flexibility to reduce or eliminate most types of interference from received voice, CW, and data transmissions. Dual Digital Signal Processors (DSP) provide simultaneous bandpass operation, noise reduction, and multiple tone removal. The Spectral NOTCH filter eliminates multiple tone interference from "tune-ups," foreign broadcast carriers, CW, RTTY, etc. A multilayer printed circuit board provides superior shielding to virtually eliminate radiation from the DSP data bus. Two methods of noise reduction are provided: Improved Spectral Subtraction (NIRR) and Improved Dynamic Peaking, to give the operator the best audio noise reduction possible.

For experimenters, access to the dual DSPs is provided via RS-232 on an internal header. The manual supplied with the unit describes this implementation.

The Improved NIRR mode of noise reduction automatically enhances voice, CW, or data signals by recognizing the speech, CW, or data and reducing the amplitude of all signals which are not part of the desired information. In addition to providing a continuously variable processing level, the NIRR control features an AUTO position to give the optimum noise reduction based on the measured signal-to-noise ratio.

The Improved Dynamic Peaking noise reduction features an external PEAK FACTOR switch to allow the operator to control the "aggressiveness" of the PEAK mode. When this mode is used in conjunction with the NIRR mode, exceptional noise reduction can be attained without damaging speech components or intelligibility.

All modes in the NIR-12, except NIRR mode, operate in "real time" with very small delay, so the unit may be used in all data modes, including ARQ modes popular with AMTOR and PACTOR. The Finite Impulse Response (FIR) filters provided in the unit have very steep skirt selectivity, linear phase in the passband, and minimum passband ripple, all desirable characteristics for good data and SSTV reproduction. The bandwidth of the filter is variable from 50 Hz to 3200 Hz, and the center frequency of the chosen filter is variable from 200 to 3400 Hz. The combination of variable filter bandwidth and variable center frequency provides exceptional "user-friendly" operation.

Installation is quite simple: The unit gets its audio input from the receiver speaker output, line output, or headphone jack, then provides volume-adjustable processed audio from its own built-in amplifier to power an external speaker of 3- to 8-ohm impedance. A line output, unaffected by the volume control, is provided for modem or phone patch.

The NIR-12 requires 12 VDC @ 1 A peak. Power adapters are available from JPS at nominal cost. Mating connectors are supplied with each unit. The unit has a one-year factory warranty and is fully upgradable.

For more information or a data sheet, contact: JPS Communications, Inc., P.O. Box 97757, Raleigh, NC 27624; (919) 790-1011, fax: (919) 790-1456. Or circle Reader Service No. 202.

GORDON WEST

Gordon West Radio School instructs both amateur radio courses and commercial radio curriculums, and now offers high-fidelity, long-play code cassettes, "commercial rated" to pass commercial first class, second class, and third class radiotelegraph licenses, as well as any level of amateur radio examination.

Radiotelegraph course 1—"Learning the International Morse Code" accelerates code character recognition with 5 wpm word rates sent with 16-20 wpm spacing. "Gordo" narrates the random runs and gives tips on preparing for any type of code exam.

Course 2—"CW speed building, 5–16 wpm" is for anyone who knows the code, but plans to build up to 16 wpm for the commercial radiotelegraph random code group test or an amateur radio General Class code test.

Course 3—"CW speed building, 10–27 wpm" prepares applicants to pass the radiotelegraph second and first class exams, with room to spare for the amateur Extra Class exam.

Each course contains six long-play cassettes, narrated by Gordon West, and packaged in a sturdy plastic cassette holder. Instructions are spoken on the tapes after each practice run.

Each course is $29.95, plus $5.00 postage and handling. Available from amateur and commercial radio dealers, or from Gordon West Radio School, 2414 College Drive, Costa Mesa, CA 92626; (714) 549-5000. Or circle Reader Service No. 208.

FT-11R/41R
2m/70cm Handhelds

- **Frequency Coverage:**
  Wide Receiver Coverage:
  FT-11: 110-180 MHz RX,
  144-148 MHz TX
  FT-41: 430-450 MHz RX/TX
- Selectable Alpha Numeric Display
- New Compact Battery Design
  4.8V produces 1.5 Watts
  9.6V produces Full 5 Watts*
- 150 Memory Channels
  (75 when Alpha Numeric)
- AM "Aircraft" Receive
  (110-136 MHz)
- Small Compact Size w/ Easy Operation (measures only: 4"H x 2¼"W x 1"D)
- Rx/Tx Battery Savers
- High-efficiency MOS FET Power Module
- Large Back-Lit Keypad and Display
- Up/Down Volume/Squelch Controls
- Built-in DTMF Paging/Coded Squelch
- Automatic Power Off (APO)
- **Accessories:**
  FNB-31 4.8V, 600 mAh Battery
  FNB-33 4.8V, 1200 mAh Battery
  FNB-38 9.6V, 600 mAh Battery
  FBA-14 6 AA Size Battery Case
  FTS-26 CTCSS Decode Unit
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  CA-10 Charge Adapter (required w/ NC-50)

*FT-11 Only.
FT-41, 3.5 Watts

"Look, alphanumeric display and a 4.8V battery. Terrific!"

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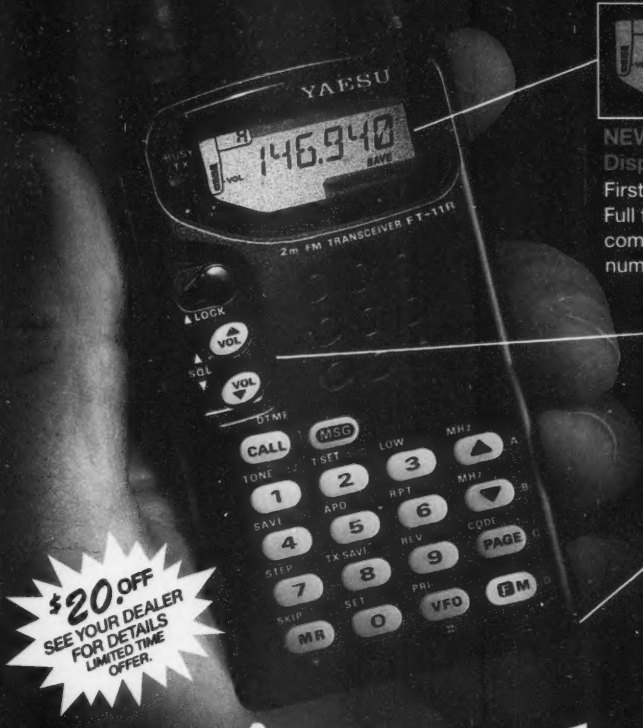

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Measures only: 4"H x 2¼"W x 1"D

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Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

Low Drain, No Pain!

TH-79A (Deluxe)
FM DUAL BANDER

Information at your fingertips. Everything you need to know about operating the new TH-79A(D) FM dual-bander (144MHz/440MHz) can be viewed in its unique dot-matrix LCD with alphanumeric display. No need for the manual. In addition to this innovative guide function, the TH-79A(D) sports a user-friendly menu system, providing easy access to the many powerful features of this slim-line handheld transceiver. Such as 82 non-volatile memory channels with ID, DTSS and page functions, and a DTMF memory function for autodial operation. Full-crossband duplex operation is available, as is the ability to receive two frequencies on the same band (VHF+VHF or UHF+UHF) simultaneously. And thanks to the FET power module, long hours of operation are possible on one charge. With the TH-79A(D), transceiver technology enters the 21st century.

NEW 5-WATT VERSION NOW AVAILABLE

Features

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- Cross-band repeater function ■ Page answer-back function
- Channel display function ■ Wideband receiver coverage, including AM receive on the aircraft band* ■ Clone function
- Modifiable for MARS/CAP use**

*Specifications guaranteed for Amateur bands only.
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